

FM 4-135

**COAST ARTILLERY
FIELD MANUAL**



**ANTIAIRCRAFT ARTILLERY
MARKSMANSHIP AND SERVICE
OF THE PIECE
ANTIAIRCRAFT MACHINE GUN**

Prepared under direction of the
Chief of Coast Artillery



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II

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III

FM 4-135

COAST ARTILLERY FIELD MANUAL

ANTIAIRCRAFT ARTILLERY

MARKSMANSHIP AND SERVICE OF THE PIECE

ANTIAIRCRAFT MACHINE GUNS

(The matter contained herein supersedes TR 435-211, May 20, 1926 (including C1, January 2, 1929); paragraphs 117 to 119, inclusive, and 175 to 183, inclusive, part two, and table N, part three, Coast Artillery Field Manual, volume II, February 1, 1933.)

CHAPTER 1

INTRODUCTION

■ 1. SCOPE.—This manual is designed for use by antiaircraft machine-gun batteries as a guide in selection of personnel, employment of practical training methods, and service of the piece. The drills are intended primarily for the use of mobile units equipped with the caliber .50 Browning machine gun on the antiaircraft machine-gun mount. Separate drills, A and B, are provided for the M2 and M1 mounts, respectively, in cases where differences in the matériel require it. These drills, with minor variations, are applicable to mobile and semimobile (see par. 42b) antiaircraft machine-gun batteries, including those equipped with the caliber .30 Browning machine gun, M1917.

■ 2. REFERENCES.—This manual should be studied in conjunction with the references listed in the Appendix. References pertaining to ammunition and to the operation, care, and maintenance of matériel are of particular importance.

SECTION II

SELECTION OF PERSONNEL

■ 7. INITIAL SELECTION.—The men of the fire unit who must be most carefully selected are the gunners, the adjusters, and the spotters. They must be mentally alert and have good vision. In addition, gunners must have considerable agility and strength and must be well-coordinated. Adjusters and spotters must react rapidly to sudden occurrences.

■ 8. FIRING TESTS.—During firing, the reaction of gunners to the shock and sound of gunfire should be noted. When the individual firings are completed, gunners are selected who are steady under the shock of firing, who can capably manipulate the mount, and who show marked ability in gun pointing. Adjusters and spotters are selected who show ability in adjusting fire promptly and accurately. As many gunners, adjusters, and spotters should be selected as can be thoroughly trained during preliminary platoon firings considering the time and ammunition available. When the platoon preliminary firings are completed, those gunners, adjusters, and spotters who have displayed the most consistent ability throughout the firings are selected for the record firings.

SECTION III

TRAINING OF PERSONNEL

■ 9. PHASES OF TRAINING.—The training of personnel is divided into three phases: preliminary training, individual firing, and platoon firing. All personnel receive training during the first and second phases. During the third phase, particular attention is given to the training of the selected gunners, adjusters, and spotters. Other personnel perform those duties within the fire unit for which they are best suited.

■ 10. PRELIMINARY TRAINING.—All personnel are trained thoroughly during the preliminary training phase. This training includes all instruction which can be given prior to actual firing on the care, operation, and manipulation of the gun and mount; the care and operation of central control equip-

CHAPTER 2

MARKSMANSHIP

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SECTION I

GENERAL

■ 3. SCOPE.—Antiaircraft machine-gun marksmanship comprises the methods of selection and training of personnel and the methods of employment of matériel required to insure effective fire of antiaircraft machine guns against suitable aerial targets.

■ 4. TARGETS.—Antiaircraft machine guns are designed for use against low-flying aircraft. These targets will normally fly at high speeds and along maneuvering courses, and will rarely remain within range as long as 20 seconds. Frequently they will appear without warning at close range.

■ 5. FIRE CONTROL METHODS.—The fleeting nature of anti-aircraft machine-gun targets makes it essential that methods of fire control be simple, accurate, and rapid in operation. Suitable methods of fire control are discussed in section V.

■ 6. SELECTION AND TRAINING OF PERSONNEL.—Efficient operation of the matériel requires that personnel in key positions be carefully selected and thoroughly trained. Other personnel should be as proficient in antiaircraft machine-gun marksmanship as the time and ammunition available will permit. Selection and training of personnel are discussed in detail in the following sections.

ment; the loading, handling, and inspection of ammunition; and gun pointing, estimation of leads, and fire adjustment. Gunners, in particular, must be thoroughly instructed in all elements of preliminary training, so that when they are actually firing, they can give as much attention as possible to pointing their guns and (when individual tracer control is used) to adjusting fire. Although preliminary training must be conducted with care, instructors must not lose sight of the fact that actual firing at high-speed targets is the part of training which produces accomplished gunners.

■ **11. INDIVIDUAL FIRING.**—Individual firing includes firing by individual gunners at balloons and towed sleeve targets. All personnel who are not experienced gunners participate in balloon firings. The purpose of balloon firing is to familiarize the men with the "feel" of the gun, to test their reaction when firing the gun, and to test their ability to adjust fire. This instruction is followed by individual firing at towed sleeve targets. Normally only those men who have shown some ability as gunners either in previous training periods or during the balloon firing just completed are allowed to fire at the towed sleeve targets.

■ **12. PLATOON FIRING.**—The instruction in platoon firing includes preliminary firings and record firings. The purpose of preliminary firings is to give gunners, spotters, and adjusters intensive training in the control of machine-gun fire, and to permit final selection of the best adjusters, spotters, and machine gunners. The purpose of record firings is to give additional training to the selected personnel and to record the state of training attained by the unit.

SECTION IV

MATÉRIEL AND AMMUNITION

■ **13. GENERAL.**—*a.* Mechanical training lends itself readily to the use of the applicatory system of instruction. Interest in this subject will be created by beginning the course with a short lecture on the history of machine guns. Sufficient data for such a lecture may be found in standard reference books. The groups of the entire unit, each with its set of equipment

and under the direct supervision of an assistant instructor, are assembled in a suitable area. The instruction is centralized under the unit instructor. Explanation and demonstration are concurrent, each assistant demonstrating the elements of the particular phase of instruction which the instructor explains from the platform. For short periods of practical work the instruction is decentralized under the assistant instructors.

b. Equipment necessary per group.—

- 1 gun.
- 1 tripod.
- 1 ammunition belt.
- 1 combination tool, if available.
- Several dummy cartridges.

c. Procedure.—(1) Have assistant instructors disassemble and assemble the gun while the instructor is explaining the procedure.

- (2) Turn the guns over to the students for practical work.
- (3) Ask questions.

d. As men become proficient in disassembling and assembling the gun, they are required to perform the operations while blindfolded. This develops a facility in handling the parts, which will be useful during action at night. The interest of the men in this work can be maintained by developing a spirit of competition among them.

■ **14. CARE AND ADJUSTMENT OF MACHINE GUN.**—This instruction includes demonstrations of the proper methods to employ in caring for the bore, the recoiling parts, and other parts of the gun, and in making adjustments of the oil buffer and head space. Detailed instructions on care and adjustment are contained in chapter 3.

■ **15. NOMENCLATURE, CARE, AND ADJUSTMENT OF MOUNT.**—For the M1 mount this instruction is of minor importance. For the M2 mount, however, careful instruction must be given. Instructions on care and adjustment of the M2 mount are contained in chapter 3.

■ **16. MANIPULATION OF GUN AND MOUNT.**—Gunners must be carefully trained to handle the machine gun with facility. Although an exact position suitable for every gunner cannot

be described, general rules can be given. The mount is provided with a back rest. The gunner assumes a stance with his feet well apart, his knees slightly bent, and his body leaning slightly backward so that his back exerts a firm pressure against the back rest. (See fig. 1.) He moves the gun in elevation by increasing or decreasing his knee bend, and moves the gun in azimuth by short, rapid shifts of his



FIGURE 1.—Position of anti-aircraft machine gunner.

feet along a circle around the mount pedestal. To assist the gunners, mounts must traverse and elevate easily. Before firing at towed targets is begun, gunners receive training in tracking high speed maneuvering targets. They are trained to track not only by use of the sights but also by looking along a line about 20 inches above and to the side of the gun. The latter method of sighting is designed to aid

the gunner in seeing through the smoke and flash of the gun while observing tracers.

■ 17. IDENTIFICATION AND CLEARANCE OF STOPPAGES.—Examples of various types of stoppages are demonstrated and the effect on automatic operation of the machine gun is explained. Each man then fires a course in stoppages. Defective ammunition is inserted in belts along with good rounds. In addition, broken firing pins, weak firing pin springs, or other defective parts are inserted in one or more guns from which good rounds are fired. When the stoppages occur, the gunner is required to identify them, clear them, and resume firing. In clearing stoppages gunners are required to employ immediate action as described in paragraph 70. In subsequent firing, gunners perform the operations of immediate action whenever a stoppage occurs.

■ 18. CARE AND OPERATION OF CENTRAL CONTROL EQUIPMENT.—The central control equipment is relatively rugged in construction and simple in operation. However, extreme care must be exercised when first operating the equipment in order to avoid damage to it. If any handwheel sticks or binds, stop turning it immediately. Do not resume operation until this trouble is corrected. Forcing the handwheel will injure the mechanism or the gun sights. Instruction should include a demonstration of the coupling and uncoupling of the equipment and an explanation and demonstration of the operation of the various parts of the system. Men should also receive practical experience in operating the equipment.

■ 19. BELT LOADING, HANDLING, AND INSPECTION OF AMMUNITION.—*a.* Instruction on the belt loading of ammunition includes methods of handling ammunition belts and the operation of belt-filling or link-loading machines. If the caliber .30 belt-filling machine is used, its care and operation are explained in detail. The operation of the caliber .50 link-loading machine is much simpler, and a brief demonstration of how to assemble the links and how to operate the machine is sufficient. For practical training, as many men as possible are given an opportunity to load ammunition during the period of actual firing.

b. Instruction in *handling ammunition* includes a demonstration of the proper method of placing loaded belts in ammunition chests. The method is described in paragraph 56f. Proper methods of handling empty belts or links and cartridge cases should also be explained.

c. Instruction on the *inspection of ammunition* includes a discussion of the various duties mentioned in paragraph 56, a demonstration of ammunition inspection, and practical work in which the men are required to pick out defective rounds in loaded belts.

SECTION V

POINTING, ESTIMATION OF LEADS, AND FIRE ADJUSTMENT

■ 20. OBSERVATION OF FIRE.—When machine guns are fired at ground targets during daylight, the fall of shots can be observed and a correction applied to place the cone of fire on the target. When firing at aerial targets, using ball ammunition alone, there is no way to determine where the shots are going. This difficulty is partially solved by using a certain percentage, normally 20 percent, of tracer ammunition. Then the bullet trajectory can be readily observed, but its position with relation to the target is still difficult to determine. This latter difficulty is of vital importance, for the high speed and maneuverability of machine-gun targets have, up to the present time, made accurate data computation impracticable, effective fire being dependent on fire adjustment based on observation of tracers. Two general methods of observing the tracers and applying corrections have been devised, individual tracer control and central tracer control. Only actual firing at aerial targets will provide satisfactory training in the use of these methods.

■ 21. INDIVIDUAL TRACER CONTROL.—Individual tracer control is a method of fire control in which each gunner observes the tracer trajectory of his own gun and makes the necessary corrections in pointing to bring his fire on the target and keep it there. In observing the tracers, he keeps his head well above and to the side of the gun in order to reduce the

blinding effect of smoke and flash, disregarding his gun sights entirely. He controls the pointing by moving the gun in azimuth and elevation at rates which keep the tracers passing through the target.

■ 22. CENTRAL TRACER CONTROL.—a. Central tracer control is a method of fire control in which the sights of all guns of the fire unit are controlled from a central point, adjustment of fire being accomplished by the application of leads at this central point based on tracer observation. Each gunner's only duty in connection with pointing is to keep the gun sights aligned with the target. In the present system of central tracer control, spotters who are located at a distance from the gun positions and adjusters at the central control box each observe the tracer trajectories of all guns simultaneously. The adjusters, aided by reports from the spotters, continuously apply the necessary corrections to the sights, by means of a data transmission system, to keep the cone of fire on the target.

b. The location of the spotters definitely affects the accuracy of their observation. On crossing courses the best results are obtained when the lateral spotter is about 100 yards nearer the target's course than is the gun position, along a line roughly perpendicular to the target's course, and the vertical spotter is about 100 yards from the gun position on the flank from which the target is coming. In cases where the target course is directly toward the gun position, lateral spotting is best from a station in the direction from which the target is coming, and vertical spotting is best from that spotting station which is the greatest perpendicular distance from the course of the target. If four spotters (see fig. 2) are stationed at about equal intervals around the gun position, and about 100 yards from it, and if lateral and vertical spotters are designated for each target approach, the above requirements can be met in most cases.

c. In addition to placing spotters in favorable locations, both spotters and adjusters should be given every possible aid in observing tracers. Binoculars with red filters, if available, will assist them greatly in seeing the tracers. Good results can also be obtained with red glasses. Polarized glass, if available is also a great assistance, particularly where

spotters, adjusters, and gunners are partially blinded by light reflected from water areas at certain times of the day.

d. The guns must be *boresighted* and must be *synchronized* with the control box to insure that proper data are set on the sights. To boresight the guns, sight each gun on a distant point and move the front sight by rotating the cable couplings until the front and rear sights are aligned with the same point. To synchronize, set the transmitters at normal readings and,

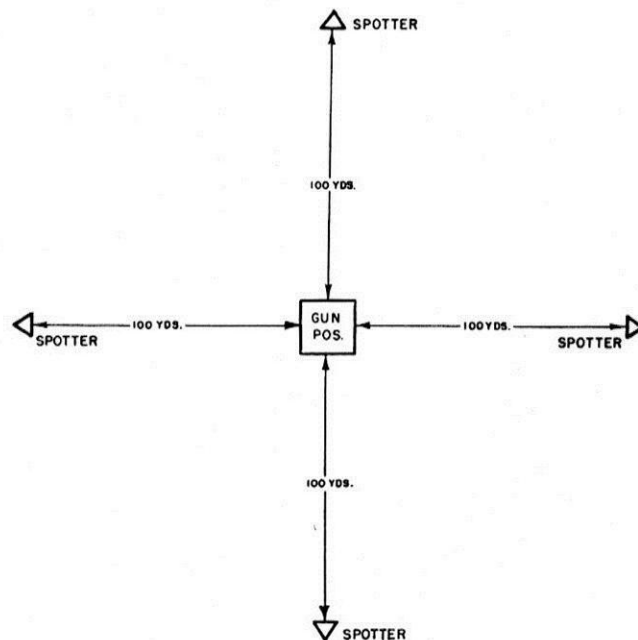


FIGURE 2.—Location of spotters.

after the guns are boresighted, connect the cables to the couplings. Note the readings on the lateral and vertical sight scales for future use in rapid synchronization. After the cables are connected, set widely varied lateral and vertical leads on the transmitters and check them against the readings on the sights of the guns. The sight readings will vary

from the transmitter readings by the amount that the sights were shifted from normal in boresighting the guns. Before attempting to boresight, provide improvised peep sights and cross hairs wherever necessary to give accurate results.

e. Due to the high rate of fire of machine guns, *barrel erosion*, after several thousand rounds have been fired, results in an appreciable loss in muzzle velocity. This loss in muzzle velocity causes the trajectory to diverge from its normal path. If badly eroded barrels are used along with new or slightly eroded barrels in a fire unit, the diverging trajectories will cause the cone of fire to be abnormally large, making adjustment of fire very difficult. To avoid this difficulty, barrels should be matched in sets showing approximately the same amount of erosion, and matched barrels should then be used in all four guns of the fire unit. Where an accurate gage for determining erosion of the barrels is not available, a loose bullet can be used. Drop the bullet, nose first, into the breech end of the barrel. The distance from the rear of the bullet to the rear of the barrel is then measured. Barrels showing approximately the same measurement should be considered about equally eroded. If time permits, a satisfactory gage can be made by boring a hole in the base of a bullet, soldering a straight length of stiff wire into the hole, and then marking off the wire in tenths of an inch from the base of the bullet for 7 inches. This gage can be used instead of a loose bullet. If a sliding collar with a tension spring is made to slide on the wire, the gage can be uniformly seated each time a gage reading is taken. When time for gaging is not available, a check of the number of rounds fired from each barrel gives an approximate method of matching. This method is inaccurate because different barrels will have been fired at varying sustained rates of fire resulting in unequal erosion from the same number of rounds.

■ 23. DIFFICULTIES ENCOUNTERED IN TRACER OBSERVATION.—a. Both methods of tracer control have distinct limitations. In each method the difficulty of observation is increased by the optical illusion of a pronounced curve in the trajectory (see fig. 3) caused by observing, simultaneously, tracers fired at

successive azimuths and by the movement of the airplane with respect to each tracer as it travels along the trajectory. *This illusion can be partially eliminated if the man observing the tracers centers his attention on the part of the trajectory in the vicinity of the target.*

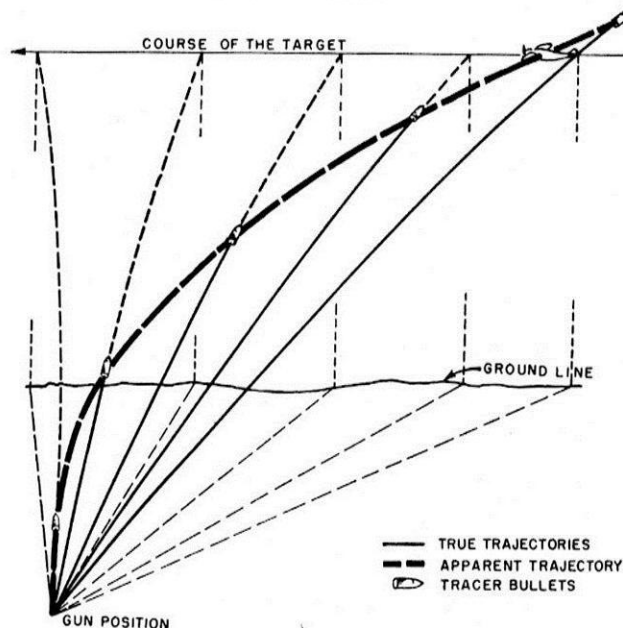


FIGURE 3.—Apparent tracer trajectory.

b. When using *individual tracer control*, gunners are partially dependent on stereoscopic vision in determining what part of the trajectory to align with the target. At slant ranges beyond 500 yards this vision becomes ineffective. A system in which the gunner counts the number of tracers from the burn-out point or the gun to locate the point on the trajectory which is at the same range as the target has been employed at times. This system has proved impracticable because estimated slant ranges are too inaccurate, the slant

ranges change too rapidly, and relative movements of the tracer and target are too great. The difficulty of observation by the gunner is increased, except at short ranges, by the relative brightness of tracers near the gun, by some smoke and flash from the muzzle, and by heavy mist or fog, if present.

c. In *central tracer control* both spotters must see the trajectory as passing through the target for fire to be adjusted. To accomplish this, the spotters continuously report to the adjusters the position of the trajectory, as seen from their position, with relation to the target. This system has one important disadvantage. If either adjuster allows the trajectory to shift from the target, the other adjuster's adjustments will be in error. This difficulty will be reduced to a minimum if adjusters are trained to avoid making corrections too suddenly. Correcting in this manner will cause the trajectory to be shifted to the target simultaneously by both adjusters and thus prevent shifting the trajectory beyond the target. Sudden and jerky fire adjustments result in a series of corrections, none of which will normally bring the trajectory to the target.

d. *Night firing* presents a special problem in fire adjustment. Although under certain atmospheric conditions tracers near the target may light it up, normally targets will be difficult to see except at close ranges. With two-station observation, it is probable that one spotter or the other will be unable to see the target continuously. The normal advantage of individual tracer control at short ranges, added to the extra advantage of having fire adjustment depend on only one man's seeing the target, makes this method of fire control the desirable one for night firing.

e. In view of the above limitations a general rule can be stated. Central tracer control, if available, should always be used unless it is impracticable as against surprise targets at short range, or at night.

■ 24. LEADS.—a. Lateral lead is the angular amount that the gun is pointed in front of the target to allow for lateral wind effect, drift, and the lateral travel of the target during time of flight. Vertical lead is the angular amount that the gun

is pointed above or below the target to allow for the vertical wind effect, superelevation, and the vertical travel of the target during time of flight.

b. Both lateral and vertical *leads change constantly* throughout the course of the target. If leads for all parts of the course could be accurately determined, fire would be kept on the target throughout the firing course. Certain methods devised for antiaircraft machine-gun fire control are based on the idea of mechanically computing these leads. Although none of the lead computers which have been tested to date has proved entirely practicable for machine guns under service conditions, the general methods employed will be discussed here. Two general methods of using computed leads have been employed.

The *first method* is the use of computing sights. These sights vary in the details of design, but have the same basic idea of furnishing the gunner with a series of reference points on the front sight which are alined in turn with the target as it proceeds along its course. Alining the target with the various points in turn has the effect of shifting the line of fire with relation to the line of sight to provide the necessary changes in leads. The disadvantages of computing sights are that there are too many possible courses to represent all of them on one sight, that the selection of the proper series of reference points must be based on an estimate and is valueless when the target is maneuvering, and that no means for applying adjustment corrections are provided.

The *second method* is by means of special data computing equipment separate from the gun. One type of separate computer consists of a director similar to that used with 3-inch antiaircraft guns. Another type consists of a simple tracking device which, when used in conjunction with disks or drums bearing curves of leads for various types of courses, permits continuous leads to be transmitted to the guns through the central control system. Disadvantages of lead computers tested up to the present time are that there is an appreciable delay in obtaining the initial leads; that the methods require an estimate of one or more of the four elements: altitude, minimum horizontal range, speed of the target, and direction of course; and that the systems cannot

be operated satisfactorily at close ranges or when the target is maneuvering.

In addition to the above disadvantages, neither method provides for small errors caused by changes in the condition of the barrel or atmospheric conditions.

c. The disadvantages which have been encountered in using any type of computer have led to the adoption of *methods of fire control* in which estimated leads are continuously applied to the guns by gunners or adjusters. Fire is adjusted by continually modifying the estimated leads, when indicated as necessary by tracer observation, to keep the cone of fire on the target. Leads applied before opening fire are known as initial leads. They should be as accurate as possible to facilitate rapid adjustment of fire. Once fire is adjusted, the gunners or adjusters must anticipate continuously the changes in the required leads if the cone of fire is to remain on the target. Estimates of leads required are based on the gunners' or adjusters' impression of the course and speed of the target and their knowledge of the leads required on various representative courses. The rapidity with which the required leads change, particularly when the target is maneuvering, makes it necessary that instinct rather than mental calculation be used in determining the leads. Intensive training is necessary to develop the ability to determine and apply leads instinctively.

d. *Training in leads* for use in central tracer control is based on angular measure. Personnel are first taught, by means of charts or tables, what the proper leads are at different parts of representative courses, and how the leads vary from course to course as the minimum horizontal range, altitude, and speed of the target are varied. This instruction is followed by practical application in which type courses are designated and the personnel are required to indicate initial leads and make the necessary changes in leads throughout the course. When the men have developed considerable ability in estimating leads, they are trained with actual aerial targets, different courses being flown during which the men estimate the type of course and call off the leads for different parts of the course. This instruction can be varied by placing inexperienced personnel at the central

control box and allowing them to set in estimated leads under the supervision of experienced personnel. This training will familiarize the inexperienced personnel with the rate of turning of the handwheels required on type courses. Where aerial targets are not available, improvised trainers may be used. Some form of movable miniature target set up to scale is suitable for this purpose. Selected personnel should then be ready to begin their training in observation and adjustment of actual tracer fire.

e. When training personnel in individual tracer control, one method sometimes employed to train inexperienced gunners in taking approximate leads is to have the instructor designate the lateral initial lead in *target lengths*. A practical rule for the instructor in quickly estimating the required lead is to take a lead of one target length per 100 yards of slant range for each 100 miles per hour of target speed. Thus, for a 100-mile per hour plane at 500 yards range the estimated lead would be 5 target lengths, and for a 200-mile per hour plane at the same range the estimated lead would be 10 target lengths. Although the estimate is only approximate and tracking an exact number of target lengths ahead of the plane until fire is opened is difficult, the method is sufficiently accurate to give the gunner some idea of proper initial leads and some chance of adjusting his fire. This method is applicable only to individual tracer control. It should not be used after the early stages of training. More experienced gunners base their estimates of initial leads on a mental picture of how the gun should be pointed with relation to the target for each type of course.

■ 25. TRAINING IN FIRE ADJUSTMENT.—*a.* During individual and platoon firing, gunners, spotters, and adjusters are trained in fire adjustment. They are corrected individually during or immediately following each course. When the tracer trajectories of the four guns are spread, the gunners are sighting or spotting poorly. When central tracer control is used and the guns shoot together but well away from the target, the spotters are spotting badly, or the adjusters are estimating leads poorly. If bullets dipped in specially prepared printer's inks of different color are used, and each gunner

fires bullets painted a distinctive color, the hits obtained on the target by each gunner can be identified. Although the percentage of hits obtained on towed targets is not, due to the element of chance, an exact index of the relative abilities of different gunners, it is the only means available for finding out what success each man is having. Similarly, painted bullets can be used to determine the hits obtained by a platoon of gunners on different courses. If a serious effort is made to conform to service conditions in methods of fire and in courses flown, and if a number of courses is considered, the percentage of hits obtained will give a good indication of the state of training of both the individual gunners and the fire unit as a whole.

b. In correcting gunners, spotters, and adjusters, any of the following errors noted are called to their attention.

- (1) Using improper initial leads.
- (2) Leading or lagging the target throughout the course.
- (3) Causing the gun or guns to shoot above or below the target throughout crossing courses.
- (4) Making sudden or excessive corrections.
- (5) Failing to manipulate the gun smoothly.

SECTION VI

FIRINGS

■ 26. GENERAL.—When preliminary training has been completed, actual firing at moving targets is begun. Individual firings at balloons and towed targets are the initial steps in this instruction. When the individual gunners are considered to be sufficiently well trained to operate in a fire unit, platoon firing is begun.

■ 27. INDIVIDUAL FIRING.—*a.* Individual firing begins with firing at free balloons. This firing is conducted on a day when there is a strong wind, in order that the problem of leads will be introduced. Only inexperienced personnel take part in this firing, and it is normally conducted only long enough to insure that each man understands how to adjust tracer fire and how to manipulate the gun. However, in cases where assigned central control equipment is unfamiliar

to all personnel of the unit, balloon courses may be fired using that equipment for fire control. Such firings will permit personnel to familiarize themselves with the operation of the handwheels and the general operation of the system. In all balloon firings the balloon is released from a point which permits the wind to carry it across the field of fire. The balloon is allowed to float with the wind until it is at about 300 yards slant range from the gun positions. COMMENCE FIRING is then given. The gunner opens fire and the gunner, or other personnel controlling fire, attempts to hit the balloon by shifting the tracer trajectory to the target.

b. When the balloon firing is completed, *firing on high speed towed targets* is begun. Courses are flown at various speeds, altitudes, and minimum horizontal ranges. As the training progresses, courses are changed from straight to maneuvering ones. At first the firing is limited to from 10 to 15 rounds per course for each gun. This will permit gunners to observe the accuracy of their initial leads without an excessive expenditure of ammunition. When the gunners and adjusters have demonstrated their ability to place the opening rounds through or near the target, firing is permitted on the entire course to allow adjustment of fire. Where target missions are limited, the number of short courses for testing the accuracy of initial leads will have to be very limited. Each gunner, spotter, and adjuster is individually corrected during or immediately after each course.

■ 28. PLATOON FIRING.—The purpose of platoon firing is to develop groups of selected gunners, spotters, and adjusters into smoothly functioning fire units. The firings are conducted with gun positions and spotting stations conforming to service requirements as closely as local conditions permit. In addition, the courses flown are varied as much as the requirements of safety will allow in order to give the fire units training in meeting all types of attack. All anti-aircraft machine-gun batteries will include firing with individual tracer control in the platoon firing, regardless of the normal method of fire control employed by the unit.

■ 29. SURPRISE ATTACKS.—The requirements of safety normally prevent anti-aircraft machine-gun units from firing at targets

towed at very low altitudes and at extremely short ranges. Surprise attacks of this type can be expected during combat. Every opportunity must be taken, therefore, to train the gunners in meeting simulated attacks at very low altitudes and short ranges. Where sufficient flying missions are available, special missions can be allotted during which these courses will be flown. When flying missions are limited, a few courses of this type can be flown before the target is let out on firing missions. Care must be taken that no live ammunition is near the gun, and that the gun is unloaded when the gunners are tracking the airplane.

■ 30. FIRING RANGES.—Tracer observation is possible out to the tracer burn-out point. For caliber .50 ammunition this point is at a range of about 1,850 yards and for caliber .30 ammunition it is at a range of about 1,000 yards. Fire should not be opened beyond these maximum tracer ranges.

SECTION VII

METHODS FOR MARKING BULLETS

■ 31. GENERAL.—The procedure for marking bullets to permit identification of hits on towed targets, which was mentioned in paragraph 25, is contained in the following paragraphs. The best results with marked bullets are obtained when firing on a white target. Blue and green marking fluids on caliber .30 bullets leave markings on red targets which can be readily identified in bright sunlight, but orange markings are unsatisfactory. Caliber .50 bullet markings on a red target are, in general, more difficult to distinguish. This is apparently due to the powder smudge deposited on the bullet when it is fired.

■ 32. PREPARATION OF MARKING FLUIDS.—a. The mixture selected as a marking fluid must mark the bullets with a thin, evenly distributed, solid coating of color which will become tacky after a drying period of about one day. A tacky coating is one that is sticky, yet not so dry as to fail to mark the fingers when touched with a moderate amount of pressure.

b. *Lithographic ink*, a type of printer's ink, thinned to a proper consistency with commercially pure spirits of turpentine, is a satisfactory marking ink. The lithographic inks are provided, under Government Printing Office formulae as indicated below, in four colors: red, orange, green, and blue. These colors have been standardized for issue to coast artillery units. The amounts of the four standard inks to be mixed with one pint of spirits of turpentine are as follows:

Red, formula No. 11257—11 ounces.

Orange, formula No. 11256—2 pounds 3 ounces.

Green, formula No. 11258—3 pounds 4 ounces.

Blue, formula No. 11259—1 pound 8 ounces.

To obtain the correct drying rate, add a small amount of castor oil in the ratio of about one tablespoonful to one pint of ink mixture. Some experimentation, however, may be necessary to determine the proper amount of castor oil to use, since atmospheric conditions, which control the drying rate, vary from place to place and in a given place at different times of the year.

c. If issue inks are not used and *mixing ratios* are unknown, prepare each mixture of lithographic ink and spirits of turpentine to a consistency approximately that of heavy cream. A little experimentation with small amounts of the different inks and spirits of turpentine will readily determine the proportion to be used. It will be necessary to repeat this experimentation for each color, for in all probability the viscosity will not be the same in each case nor will like quantities of the different inks weigh the same. The mixing ratios given for the standard inks may be of assistance in determining proper mixing ratios for unknown inks. A simple means of checking the relative viscosities of different ink mixtures is to put several drops of each mixture on a clean pane of window glass, tilt the glass to an angle of about 45°, and observe the rates of flow.

■ 33. **CLEANING BULLETS.**—Before attempting to apply the marking fluid, wipe all grease and dirt from the bullets with a cloth moistened with turpentine. Unless the bullets are clean, the ink will not adhere.

■ 34. **PROCEDURE IN MARKING CALIBER .30 BULLETS.**—Either of two methods may be used, depending upon the amount of ammunition to be marked.

a. The first method is used when *more than one belt of ammunition* is to be marked. Coil up each loaded ammunition belt tightly, keeping the points of the bullets in the same plane, and tie securely with stout twine. Carefully dip the bullets to a depth of about three-eighths of an inch into a flat, shallow pan, such as a lard can cover, which is level and contains the marking fluid. After dipping, place the coiled belt, with bullet points down, on a piece of newspaper or other absorbent material, and allow to drain. After about 5 minutes, move the belt to a clean part of the paper and again allow to drain. Repeat this after 10 minutes, and again after 15 minutes. By this time the draining process should be practically complete and the bullets, still in the coiled belt and with points down, are left to dry until the next day. The purpose of this draining and moving process is to remove the excess ink which gathers at the points of the bullets. Failure to do this will change the trajectory of the bullets.

b. The second method is used when *one belt or less of ammunition* is to be marked. Tack the loaded belt along a piece of 2- by 4-inch timber so that the points of the bullets extend beyond the edge about an eighth of an inch. Next, support the timber at each end, by any convenient means, with the bullets pointing down. With a small receptacle containing marking fluid to a depth of about three-eighths of an inch, mark each bullet separately. The bullets stand away from the timber, permitting this operation. After marking, place the timber, with the loaded belt still attached, on a piece of newspaper or other absorbent material so that the bullets are resting on their points, and proceed with the draining process as in the first method. This method of marking bullets is fairly rapid and is economical in the use of the marking fluid.

■ 35. **PROCEDURE IN MARKING CALIBER .50 BULLETS.**—A caliber .50 ammunition chest contains 200 rounds of ammunition. One hundred rounds, in the metallic link belt, may be conveniently marked in one dipping. The number of rounds to be marked

is divided into linked sections of 100 rounds or less, and dipped and drained in the manner prescribed for the first method of marking caliber .30 bullets. Several rounds are marked separately and, after drying, are used to join 100-round sections into 200-round belts. The caliber .50 bullet is marked to a depth of about one-half of an inch measured along the ogive from the point.

■ 36. DRYING PERIOD.—Bullets marked on the day before the firing should become dry enough on the day of firing to permit handling and yet remain sufficiently tacky to afford excellent target-marking results. If necessary, the period of time between marking and firing may be extended to 3 days and still afford target markings which can be identified. The 1-day drying period, however, is considered the best. After a period of more than 3 days, the markings cannot be depended upon, and the bullets should be cleaned and re-marked. Dry-cleaning solvent may be used effectively in cleaning marked bullets.

■ 37. MISCELLANEOUS.—*a.* It is considered impracticable to furnish *prepared ink mixtures*, in lieu of the ingredients for mixing, for the reason that ready prepared mixtures would not have a drying rate satisfactory for all climates and all conditions.

b. When *mixing* the ingredients, stir thoroughly.

c. Four colors of ink will normally suffice. Should a fifth identification be required, unmarked bullets can be used.

d. The approximate quantities of marking materials required for caliber .30 ammunition are—

(1) *Inks, lithographic.*

(*a.*) *Red* (Formula No. 11257).—One pound for the first 1,000 rounds plus one-third pound for each additional 1,000 rounds.

(*b.*) *Orange* (Formula No. 11256).—Three times the quantity required for red ink.

(*c.*) *Green* (Formula No. 11258).—Five times the quantity required for red ink.

(*d.*) *Blue* (Formula No. 11259).—Two times the quantity required for red ink.

(2) *Spirits of turpentine*.—Three pints for the first 1,000 rounds plus three-eighths of a pint for each additional 1,000 rounds.

(3) For marking caliber .50 ammunition, the quantities of ink and turpentine required are twice those necessary for marking caliber .30 ammunition.

(4) The quantity of castor oil required varies with climatic conditions. Normally 1 quart will be sufficient for either caliber of ammunition for the entire training period.

SECTION VIII

DATA TRANSMISSION

■ 38. GENERAL.—*a.* The selection of a data transmission system for use with antiaircraft machine guns is directly related to the problem of marksmanship when central control is used. When using individual tracer control, no data transmission system is required. The central control system must permit application of data to the machine-gun sights continuously and practically instantaneously, as any delay in changing leads and applying corrections makes fire adjustment useless. The central control system must function efficiently during the shock and noise of actual firing, must permit free movement of the gun, and must not interfere with the action of the gunner.

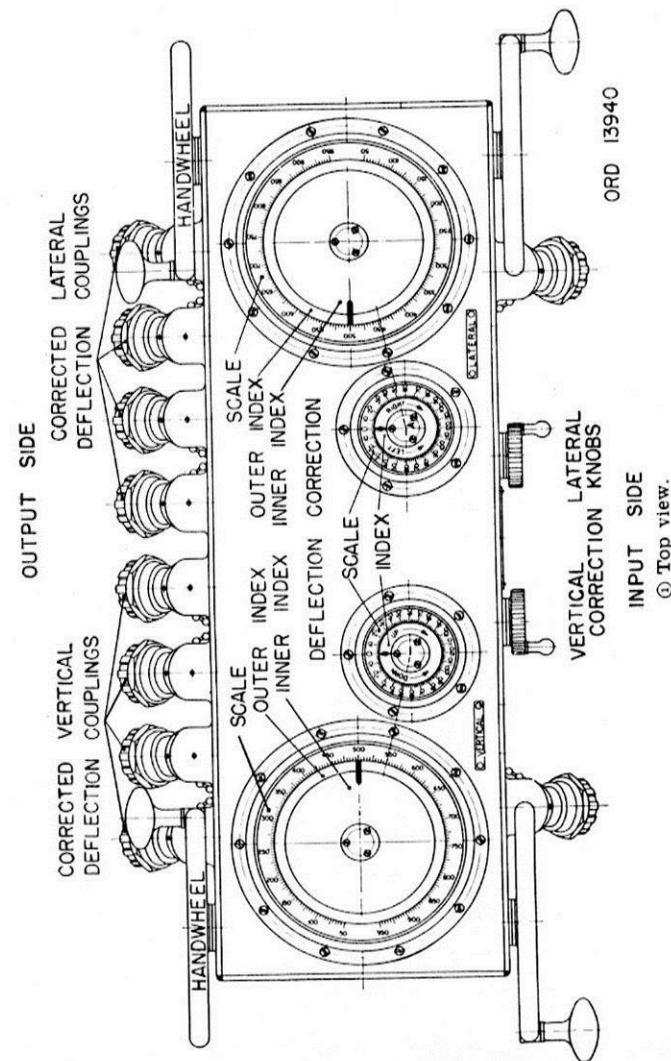
b. There are three general methods of data transmission: telephonic, mechanical, and electrical. They may be used separately or in any combination, depending on the system desired and the equipment available.

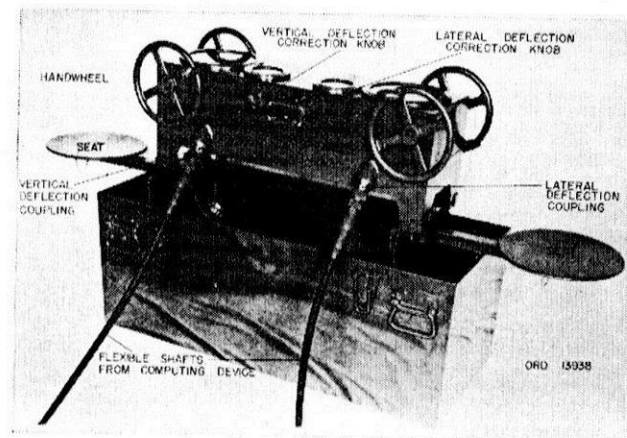
■ 39. DATA TRANSMISSION BY TELEPHONE.—When this type of transmission is employed, the spotters are directly connected with the assistant gunners by telephone. Spotters continuously indicate the lateral and vertical leads. Initial leads and changes in leads, as received from the spotters, are set on the sights by the assistant gunners. This operation is difficult to perform smoothly, particularly when the mount is vibrating from gun fire, and may seriously interfere with the gunner. This system is not very rapid. In addition, the assistant gunner frequently has difficulty in understanding the spotter

while the gun is firing. A telephonic data transmission system therefore is not considered satisfactory except as an emergency method.

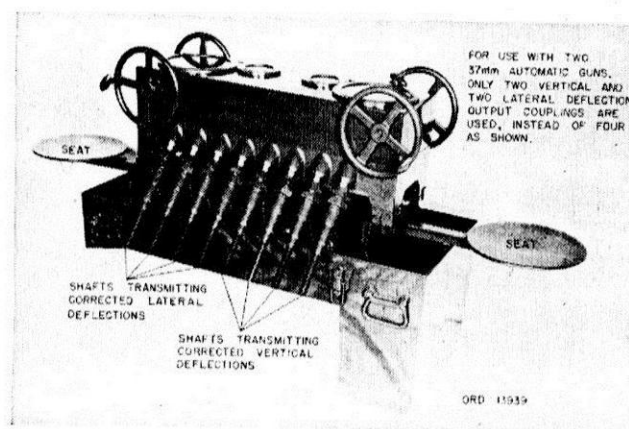
■ 40. MECHANICAL DATA TRANSMISSION.—Mechanical data transmission has been tried at different times with various types of shafting. The best mechanism employs flexible shafts which are used in the standard central control system. In this system lateral and vertical leads are set on scales in the central control box (see fig. 4). In matching indexes, two operators turn handwheels controlling the rotation of flexible shafts which, through gearing, cause the sights on each gun to be moved the proper amount laterally and vertically. Lateral and vertical leads are set into the central control box by either of two methods. In the first method, each spotter sets leads into the control box through the transmitter flexible input shafts. The leads set in can be modified by adjusters at the central control box by means of correction knobs which control correction scales and affect the lead or deflection scales. This method of setting in leads has the disadvantage that only one lateral and one vertical transmitter are provided. In the second method, no flexible shaft is used between the spotters and the central control box. Telephone lines are arranged so that each spotter can be connected by telephone with either of the adjusters at the control box to permit his use as a lateral spotter or as a vertical spotter. The adjusters set the proper leads by means of the correction knobs and adjust fire, modifying their leads by their observation of the tracers, assisted by the observation of the spotters. Since adjusters are provided with helmets, the telephone communication will not be appreciably affected by the noise of firing. Data transmission by means of telephone and flexible shafts is as rapid and accurate as any method yet devised.

■ 41. ELECTRICAL DATA TRANSMISSION.—An electrical data transmission system which would permit the spotters to control directly the movement of the gun sights would be the best possible transmission system. At the present time, no such system is available. However, a similar system has been used wherein self-synchronous transmitters and receivers





② Input side



③ Output side.

FIGURE 4.—Central control box.

were employed for lateral and vertical lead transmission. Each receiver had an electrical index controlled by the transmitter and a mechanical index which controlled the movement of the sight laterally or vertically by means of a short flexible shaft. When the indexes were matched, the transmitted leads were set on the sights. This system only provides transmitters for one lateral and one vertical observer and does not permit direct control of the gun sights by the spotter. Until these problems are solved, the telephone flexible-shaft system is the best available.

CHAPTER 3

SERVICE OF THE PIECE

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SECTION I

ORGANIZATION OF THE MACHINE-GUN PLATOON

■ 42. COMPOSITION.—*a.* The *antiaircraft machine-gun platoon* comprises a platoon headquarters and range section and two machine-gun sections. Each machine-gun section is composed of a chief of section and two machine-gun squads. When firing with central control, the platoon is the fire unit, the central control equipment being operated by the platoon headquarters and range section. When firing with individual tracer control, the platoon, section, or squad may be the fire unit.

b. (1) The *war strength machine-gun squad of mobile units* consists of the squad leader, four machine gunners (gunner, No. 1; assistant gunner, No. 2; assistant gunner, No. 3; and water pump operator, No. 4) and one chauffeur and ammunition detail, No. 5.

(2) The *peace strength machine-gun squad of mobile units* is reduced by one machine gunner, No. 3, the duties of No. 3 being performed by the squad leader in addition to his other duties. In moving the gun to and from position, the squad leader carries the first load prescribed for No. 3, the remaining loads being handled as directed by the squad leader.

(3) The *war strength machine-gun squad of semimobile units* is the same size as the peace strength mobile squad.

The drill is the same as for the latter, except that No. 5 has no duties as chauffeur.

(4) The *peace strength machine-gun squad of semimobile units* consists of the squad leader and three machine gunners (gunner, No. 1; assistant gunner, No. 2; and water pump operator, No. 4). The duties of No. 3 are performed by the squad leader as in (2) above. The duties of No. 5 are performed by No. 2, assisted by No. 4 when necessary.

(5) When matériel of semimobile units is being mounted or dismounted or moved to or from the position, the members of the squad perform duties as directed by the squad leader. When the guns are not mounted in trucks during a movement, the parts of the mount are moved to the position in the order in which they will be set up and are removed from the position in the order in which they are disassembled.

■ 43. FORMATION.—*a.* The machine-gun platoon (see fig. 5) assembles with the platoon headquarters and range section on the right, the gun sections successively on the left at 4-pace intervals. Each section assembles in two ranks with 4 inches between files and 40 inches between ranks, subdivisions in numerical order from right to left. Within subdivisions, men form in numerical order with odd numbers in the rear rank and even numbers in the front rank.

b. When carrying machine guns and heavy equipment, squads normally move as separate units, at ease, and in such formation as permits the most efficient handling of the matériel.

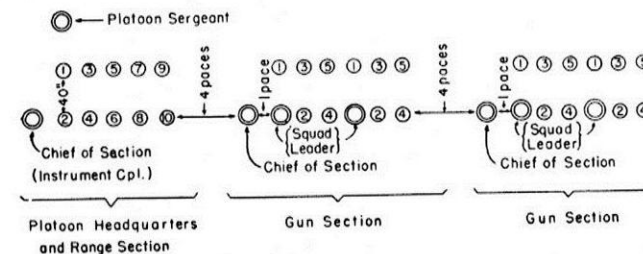


FIGURE 5.—Formation of mobile machine-gun platoon (war strength).

SECTION II

DUTIES OF PERSONNEL

■ 44. **PLATOON COMMANDER.**—*a.* The platoon commander commands the platoon and is responsible for the efficiency of the personnel and the condition of the matériel assigned to it.

b. He is responsible that all safety precautions pertaining to the service of the piece are observed by the platoon.

c. He is responsible for the fire direction of the platoon.

d. When the platoon operates as a unit, he is responsible for the conduct of fire of the platoon.

e. He is responsible for the proper emplacement of the guns and adequate camouflage and local defense of the position.

■ 45. **CHIEF OF SECTION.**—*a.* The chief of section is in command of the machine-gun section and is responsible for the efficiency of the section and for the condition of matériel under his charge.

b. When the section operates independently, he is responsible for the conduct of fire of the section.

c. When, for any reason, the platoon commander cannot direct the fire of the section, the chief of section assumes that duty.

d. He is responsible that all safety precautions pertaining to the service of the piece are observed by the section.

e. When the section operates independently, he is responsible for the proper emplacement of the guns and adequate camouflage and local defense of the position.

■ 46. **SQUAD LEADER.**—*a.* The squad leader is in command of the machine-gun squad. He is responsible for the efficiency of his squad and for the condition of the matériel under his charge.

b. He supervises the service of the piece, including emplacement of the machine gun and service of ammunition.

c. He personally directs the work of care and preservation of matériel assigned to the squad.

d. He is responsible that all safety precautions pertaining to service of the piece are observed by his squad.

SECTION III

DRILL OF THE MACHINE-GUN SQUAD

■ 47. **PREPARE FOR ACTION.**—Drill A is employed when the M2 pedestal mount is used, drill B when the M1 tripod mount is used.

a. Drill A.—The machine gun being mounted in firing position in its assigned truck, at the command **PREPARE FOR ACTION**, the squad leader repeats the command, indicates the location of the emplacement, and checks to see that the gun is not loaded. No. 5 maneuvers his truck as close to the emplacement as circumstances permit, dismounts, and lowers the tail gate. No. 4 disconnects the water hoses from the gun and coils them on the water chest. No. 1, assisted by No. 3, removes the ammunition chest from the mount and the link bag from the link chute, dismounts the gun, and passes the gun off the rear of the truck to No. 2, who then proceeds to the emplacement. Nos. 1 and 3 remove the gun cradle, take it off the rear of the truck, and follow No. 2. Nos. 4 and 5 remove the legs from the pedestal. No. 4 takes the pedestal off the rear of the truck and follows Nos. 1 and 3. No. 5 follows No. 4 with the legs. The squad leader picks up the spare parts chest and follows No. 5, assisting him in carrying the legs if necessary. Upon arrival at the emplacement, the squad leader indicates the exact location in which the gun is to be emplaced and supervises the mounting of the gun. Nos. 4 and 5 assemble the pedestal and legs and then return to the truck for the water chest and hoses. Nos. 1 and 3 mount the cradle. No. 3 returns to the truck for an ammunition chest and the link bag. Nos. 1 and 2 mount the gun, boresight the gun, if necessary, and assist members of the platoon headquarters and range section in attaching the central control cables, if used, to the sighting mechanism. No. 3 brings up the ammunition chest and link bag and places them in position on the mount. No. 4 connects the water hoses to the gun. Nos. 2 to 4 then carry the remaining ammunition chests, the water containers, and the link-loading machine from the truck to the emplacement. When all equipment is removed from the truck, No. 5 puts up the tail gate, moves his truck

to the designated parking area, and then returns to the emplacement. As their duties are completed, the members of the squad take post as follows: No. 1 in rear of the gun, No. 2 on the left of the gun and facing it, No. 3 on the right of the gun and facing it, No. 4 at the water pump, No. 5 near the reserve ammunition. (See fig. 6.)

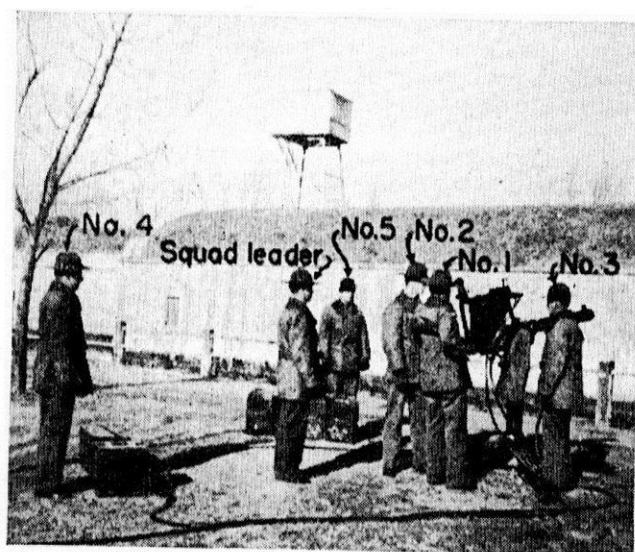


FIGURE 6.—Machine-gun squad ready for action.

b. Drill B.—This drill is the same as drill A except in the details of assembling and disassembling the mount. After the gun is dismounted, No. 3 removes the yoke and follows No. 2. Nos. 1, 4, and 5 then fold up the tripod, remove it from the truck, and follow No. 3. Upon arrival at the emplacement, Nos. 1, 4, and 5 set up the tripod. No. 3 then mounts the yoke.

■ 48. **EXAMINE GUN.**—The gun being emplaced and all details at their posts, the squad leader commands: **EXAMINE GUN.** He inspects the spare parts chest and then supervises the examination of the other equipment. No. 1 sees that

the gun and mount are in good working order and adjustment, that the sighting mechanism, if used, operates properly, and that the gun elevates and traverses freely. He then reports, "Gun and mount in order." No. 2 sees that there is one ammunition chest on the gun and that a full ammunition chest is conveniently located. When no firing is to occur, he sees that there is no live ammunition near the gun. He then reports, "Ammunition in order." No. 3 checks the cables, if used, to see that there are no kinks and that there is sufficient slack. He then reports, "Cables in order." No. 4 sees that the water jacket is filled, that all water plugs and hose connections are tight, and that the water chest is filled and in working order. He also sees that a full water container is conveniently located. He then reports, "Water pump in order." No. 5 inspects the reserve ammunition and the link-loading machine, and if no firing is to occur, sees that no live ammunition is near the reserve chests. He then reports, "Reserve ammunition in order." When all men have reported to the squad leader, he reports to the chief of section, "No. ---- in order," or defects he is unable to remedy without delay.

■ 49. **LOAD.**—The squad leader repeats the command **LOAD.** No. 3 raises the cover and then unclamps the cradle. No. 2 opens the ammunition chest and feeds the end of the ammunition belt into the receiver until one round is beyond the belt-holding pawl. No. 3 then lowers the cover. No. 1 then pulls back on the bolt handle or bolt slide twice. When loading the caliber .30 machine gun, No. 3 assists in loading by pulling on the brass tab of the belt until the first round is engaged.

■ 50. **TARGET.**—The squad leader repeats the command **TARGET.** He assists No. 1 in locating the target. No. 1 begins to track the target by traversing and elevating or depressing the gun and then calls out, "On target." The squad leader watches the cables to see that they do not become kinked or too tight. In assigning the target in units which normally employ central tracer control, the command **TARGET—GUNNER'S ACTION** is given if it is desired to employ individual tracer control.

■ 51. **COMMENCE FIRING.**—No. 1 continuously presses the trigger and tracks the target with his sights (central control) or with the aid of tracers (individual tracer control). If stoppages occur, he clears them with the aid of Nos. 2 and 3. No. 2, aided by No. 5, replaces the ammunition chest with additional chests as required. No. 3 removes, empties, and replaces the link bag when necessary. No. 4 operates the water pump. No. 5 brings up reserve ammunition chests to the gun when called for by No. 2, loads additional belts, and obtains ammunition from the platoon when required. The squad leader continues to keep the cables unkinked and clear of the gunner.

■ 52. **SUSPEND FIRING.**—The squad leader repeats the command **SUSPEND FIRING**. No. 1 releases the trigger and continues to track the target. No. 4 continues to operate the water pump. No. 5 continues his duties as at **COMMENCE FIRING**. The squad leader continues to keep the cables unkinked and clear of the gunner.

■ 53. **CEASE FIRING.**—The squad leader repeats the command **CEASE FIRING**. No. 1 releases the trigger and stops tracking the target. No. 3 clamps the cradle. No. 1, assisted by No. 2, unloads the gun. No. 2 replaces the belt in the ammunition chest and closes the top of the chest. He replaces the ammunition chest, if necessary. No. 3 removes the link bag, empties the links into a suitable receptacle, and then replaces the link bag. He collects the empty cartridge cases and places them in suitable receptacles. No. 4 continues to operate the water pump for about 20 full turns of the pump handle after the gun ceases firing. If necessary, he changes the water in the water chest. No. 5 replaces the empty ammunition chest with a full one, if necessary. He loads belts with the assistance of other members of the squad until all ammunition chests are full.

■ 54. **MARCH ORDER.**—*a. Drill A.*—The squad leader repeats the command **MARCH ORDER**. He sees that the gun is unloaded and then supervises the dismounting of the gun. No. 5 gets his truck and maneuvers it as near the emplacement as possible. Nos. 1 and 2 assist the platoon headquarters and

range section in detaching the central control cables, if used. The gun is then dismounted as described under **PREPARE FOR ACTION**. The squad proceeds to the truck in the order: squad leader carrying spare parts chest, No. 5 carrying tripod legs, No. 4 carrying pedestal, Nos. 1 and 3 carrying cradle, No. 2 carrying gun. The gun is then mounted in the truck in the manner described under **PREPARE FOR ACTION**. The mount is secured to the truck body so that it is steady but can be quickly dismounted. The squad leader sends Nos. 2 to 4 for the remainder of the equipment, supervises the loading of men and equipment, and then inspects the emplacement. No. 5 then closes the tail gate and maneuvers his truck as directed by the squad leader.

b. Drill B.—This drill is the same as drill A, except for the variations in disassembling and assembling the mount indicated in drill B under **PREPARE FOR ACTION**.

■ 55. **GENERAL.**—Machine-gun units are often compelled by tactical requirements to make frequent and rapid changes of position. To accomplish these movements in the minimum possible time, all machine-gun units must be trained to perform all duties connected with going out of position, going into position, and preparing to open fire, with the greatest possible speed. Performance of the above drills in competition with other squads or against time will be found invaluable in attaining the required speed.

SECTION IV

NOTES ON DRILL

■ 56. **INSPECTION OF AMMUNITION.**—Ammunition is carefully inspected immediately after belting and then placed in ammunition boxes to protect it against damage in handling. Inspection of ammunition includes the following duties:

a. See that each round is serviceable; that is, that there are no loose rounds (bullet loose in the case), short rounds (bullet pushed too far into the cartridge case), thick or thin rims, inset primers, or split, battered, or dented cases. Short rounds can be readily determined by stretching out the loaded belt and either passing it through a trough

of the same width as the length of the rounds or placing the bases against one flat board, resting a second flat board against the bullet points, and noting the rounds which do not touch the second board. Thick or thin rims are observed by comparison with the rims of adjacent rounds. Cases with mouth splits may be detected by exerting a bending force on the bullet. An empty cartridge case placed over the bullet aids in this inspection. Body or shoulder splits may be detected by pressing on the cartridge case near the bullet. Inset primers are primers set too far in from the base of the cartridge.

b. See that the cartridges are properly alined in the belts.

c. See that the proper proportion of *tracer ammunition* is contained in each belt.

d. See that web belts are clean and dry and have no torn loops and that the links of link belts are not bent or battered.

e. When caliber .50 ammunition is used, it must be loaded into the belts for left-hand feed so that when the points of the bullets are toward the front and the flat side of the links is down, the double loop of each link will be to the right. When loading for right-hand feed, the double link must be to the left.

f. In loading ammunition belts in the ammunition chests (see fig. 7), the end of the belt having the open single loop is rolled on the reel and the remainder of the belt folded

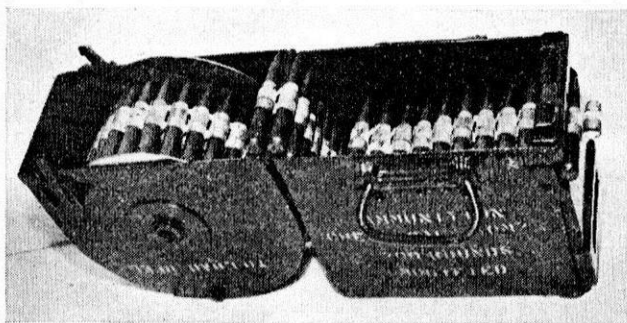


FIGURE 7.—Loaded ammunition chest.

into the body of the chest so that the end with the double loop lies on top ready to be fed into the receiver.

g. Ammunition should not be handled more than is necessary. If, for any reason, caliber .50 ammunition is removed from link belts and then loaded in belts again, a careful inspection for short rounds must be made when the belting operation is completed.

■ 57. PROTECTION OF SIGHT MECHANISM.—a. When central control is used with the M2 mount, care must be taken that the cover is not raised while the sight mechanism is being operated. The sight assembly projects downward from its support, and if the cover is raised, the assembly, in moving laterally, will strike it. If this contact occurs with sufficient force, parts of the sight mechanism will be sprung.

b. At the conclusion of drill, if the guns and mounts are to remain in position, run the elevating screw of the front sight mechanism down as far as possible to protect it against possible injury. When movements are made from one emplacement to another, remove the sighting mechanism from the mount.

■ 58. DISMOUNTING GUN.—Before removing the caliber .50 machine gun from the cradle of the M2 mount, force the gun slightly to the rear and push down the lower recoil slide stop which is located on the right of the lower recoil slide. This will prevent the recoil slide from going too far forward when the gun is removed. If this is not done, difficulty will be encountered in properly alining the slide and the gun bracket to insert the rear gun attachment pin when mounting the gun. This stop will return automatically to the disengaged position after the first round is fired. Release the trunnion cap wing nuts and raise the trunnion caps. Pull out the rear gun attachment pin and lift the gun out of the cradle. In removing the gun, do not allow the side plate trigger to come into contact with the cradle, as such contact may injure the trigger mechanism.

■ 59. REMOVING TRIPOD LEGS, M2 MOUNT.—Unscrew the leg-clamping ring. Release the nuts on the bolts which fasten the tripod legs to the base ring by screwing the nuts out against the stops. Remove the tripod legs by sliding them

downward out of the slots in the base ring. In removing the legs, tilt the pedestal so that the leg being removed is clear of the ground. In assembling, hold the pedestal upside down until the legs are attached.

■ 60. PROTECTION OF CENTRAL CONTROL EQUIPMENT.—The control box should be kept in its chest when the central control system is uncoupled. All control equipment must be handled with particular care in moving it from place to place. In withdrawing cables from receptacles, grasp the plug and not the cable. When it is necessary to move the cable by pulling it, grasp the cable and not the plug. When cables are disconnected, care must be taken to insure that caps are kept on all cable plugs and receptacles to prevent burs and the collection of grit and dirt in the threads or slots.

■ 61. UNLOADING GUN.—The procedure in unloading the gun is to raise the cover, remove the ammunition belt, and retract the bolt. Make a visual inspection of the feedway, T-slot, and chamber to insure that the gun is unloaded. Release the bolt, lower the cover, and press the trigger.

■ 62. COUNTERBALANCE FOR CALIBER .30 GUN.—When the caliber .30 machine gun is used on the M2 mount, the assembly of gun and cradle is out of balance. Although the gun can be aimed and fired without too much difficulty while unbalanced, some form of improvised counterbalance will aid the gunner in the manipulation of the gun and mount.

SECTION V

ADDITIONAL INFORMATION ON SERVICE OF THE PIECE

■ 63. GENERAL INSTRUCTIONS.—*a.* The service of the piece is conducted with dispatch and precision and with as few orders as possible. Except for the necessary orders, reports, and instructions, no talking is permitted.

b. Gunners change positions at a run.

c. Commands are given in the prescribed form and signals substituted for commands whenever practicable.

d. The commands or signals, ELEVATE, DEPRESS, RIGHT, OR LEFT, given in pointing, refer to the direction of motion of the muzzle.

■ 64. SAFETY PRECAUTIONS.—*a.* Safety precautions to be observed in time of peace are prescribed in FM 4-120. The principles indicated should be applied under war conditions where circumstances permit.

b. The following additional precautions are prescribed in time of peace for the safety of towing airplanes or personnel on the firing line:

(1) At the command SUSPEND OR CEASE FIRING, the assistant gunner, No. 2, taps the gunner smartly on the back or hand.

(2) No live ammunition will be allowed near the emplacements except when firing is to take place.

(3) The covers on all machine guns will be partially raised and the guns unloaded except when the guns are firing or are about to fire.

(4) When tracking a target, the gunner will not touch the trigger until his sights are alined with the target and the field of fire has been indicated as safe.

(5) At the beginning of courses machine guns must be kept depressed considerably below the elevation of the towing airplane until it has cleared the line of sight.

(6) While a stoppage is being cleared, the machine gun will be pointed at a safe part of the field of fire. This requirement will not prevent continued tracking of the target so long as the field of fire is safe.

(7) Men will be trained always to pass in rear of the gun in going from one side to the other.

(8) If malfunctioning of the gun causes it to fire continuously while the trigger is not being pressed, the firing can be halted by grasping the ammunition belt and twisting it with force so that the rounds cannot enter the feedway.

(9) *During peacetime firing* where guns are arranged to simulate combat positions extreme care must be taken to observe every possible precaution against accident to personnel. The measures taken will include the use of machine gun pits, sandbags, and minimum elevation stops for the machine guns.

(10) In all cases where aerial targets are towed over or close to the gun positions at low altitudes, provision must be made for the safety of personnel against a *dragging towline cable*. The cable may drag if the target is accidentally released or when the last target is dropped.

■ 65. SERVICE OF AMMUNITION.—*a.* Ammunition is issued by the machine-gun platoon to the squad as individual rounds. It is the responsibility of each machine-gun squad to load this ammunition into belts, inspect it, and place it in ammunition chests, using any personnel temporarily free from other duties between actions.

b. Each machine-gun squad is responsible for returning boxes of empty cartridges to the platoon and for carrying additional ammunition to its emplacement.

c. Where continued action makes it necessary for the squads to have assistance in loading belts, men from the platoon headquarters and range section assist in the work.

■ 66. ACTION ON THE MARCH.—*a.* Except for the minor variations indicated below, *drill and fire action on the march* are conducted in the same manner and by the same commands as normally.

b. At the command or signal POSTS, the squad leader immediately commands: LOAD. Nos. 1 and 2 load the gun and take positions which will enable them to maintain a sharp lookout and to open fire in the minimum time after discovery of the hostile airplane or airplanes. Other members of the squad keep a careful watch in assigned directions. Any member of the squad sighting a hostile airplane immediately calls out "Target," and points to the airplane. The squad leader signals TARGET by whistle. Whenever the squad leader hears the command or signal TARGET anywhere in the column, he directs the driver to stop his truck.

c. Gunners are given their instructions relative to the engagement of targets prior to the beginning of the movement. Limited only by such instructions and the necessity for avoiding casualties to adjacent troops, gunners open fire on hostile targets at the earliest possible moment without command, and cease fire only on orders or when the target passes out of range.

d. Squad leaders, in addition to their usual duties during firing, see that only suitable targets are engaged and that advance instructions as to the fire action are carried out. They suspend or stop the firing when necessary and execute any command received. During action squad leaders dispose their men in such manner as to interfere as little as possible with the operation of the machine gun, to obtain the maximum protection for the personnel, and to facilitate the supply of ammunition and water.

■ 67. PREPARATION OF POSITION.—The preparation of positions is discussed in FM 4-105. The selected position must have the maximum possible concealment, and the personnel, weapons, and equipment must have the maximum possible protection consistent with the efficient operation of the platoon. Under no circumstances will personnel be exposed needlessly. The amount of protection and concealment to be provided will largely depend upon the time available.

SECTION VI

STOPPAGES AND IMMEDIATE ACTION

■ 68. DEFINITIONS.—*a.* A stoppage is any unintentional cessation of fire.

b. Immediate action is the procedure used for the prompt reduction of usual stoppages.

■ 69. STOPPAGES.—*a. Prevention.*—Stoppages will be reduced to the minimum if the gunner has a practical working knowledge of his weapon and applies the points which should be observed before firing. *Prevention is the best remedy for all stoppages.*

b. Causes.—(1) A stoppage will occur if the gun fails to feed, fails to load, or fails to fire.

(a) If the gun fails to feed, the cause for stoppage will be found in the ammunition belt or feed mechanism.

(b) If the gun feeds but fails to load, the cause will be found in the receiver. A broken part or an obstruction on the T-slot or in the chamber are the usual causes.

(c) If the gun feeds and loads but fails to fire, the cause will be found in the firing mechanism unless the primer of the cartridge is defective.

(2) The following table includes a comprehensive list of possible stoppages. It will serve as a guide during instruction in stoppages or immediate action.

TABLE OF STOPPAGES

Stoppage	Method of preparation for instruction in immediate action and stoppage
1. Misfire due to defective primer.....	1. Place dummy cartridge in belt.
2. Short round.....	2. Place short round in belt.
3. Bulged round.....	3. Insert bulged round in belt.
4. Tight link in belt ¹	4. Do not prepare.
5. Thin rim, permitting nose of bullet to drop below chamber. ¹	5. Do not prepare.
6. Belt improperly loaded.....	6. Pull cartridge partially out of belt.
7. Battered or thick rim of cartridge.....	7. Place battered or a thick-rimmed cartridge in belt.
8. Failure to remove round from chamber.	8. Place dummy cartridge with rim filed off in chamber.
9. Set-back primer ¹	9. Do not prepare.
10. Separated case which is removed from chamber by new round when bolt is pulled to rear.	10. Drive front portion of a cartridge securely on a dummy cartridge. Pull bolt to rear and place cartridge properly on face of bolt. Ease bolt forward.
11. Separated case which stays in chamber when bolt is pulled to rear. (Do not set up loose head space.)	11. Insert front end of separated case in chamber and load.
12. Bullet loose in cartridge case. Cartridge case extracted from belt but bullet remains in belt. ¹	12. Do not prepare.
13. Short or broken firing pin.....	13. Place 5 or 6 successive range dummy cartridges in belt for instruction in immediate action.
14. Weak or broken firing pin spring.....	14. Same as 13.
15. Faulty engagement of firing pin and sear notch.	15. Same as 13.
16. Broken sear spring.....	16. Same as 13.
17. Bent or worn belt feed lever.....	17. Assemble cover with defective part.
18. Belt feed pawl spring out or weak	18. Remove belt feed pawl spring.
19. Belt feed pawl pin out or partially out.	19. Remove belt feed pawl pin.

¹ Not prepared for instruction in immediate action.

TABLE OF STOPPAGES—Continued

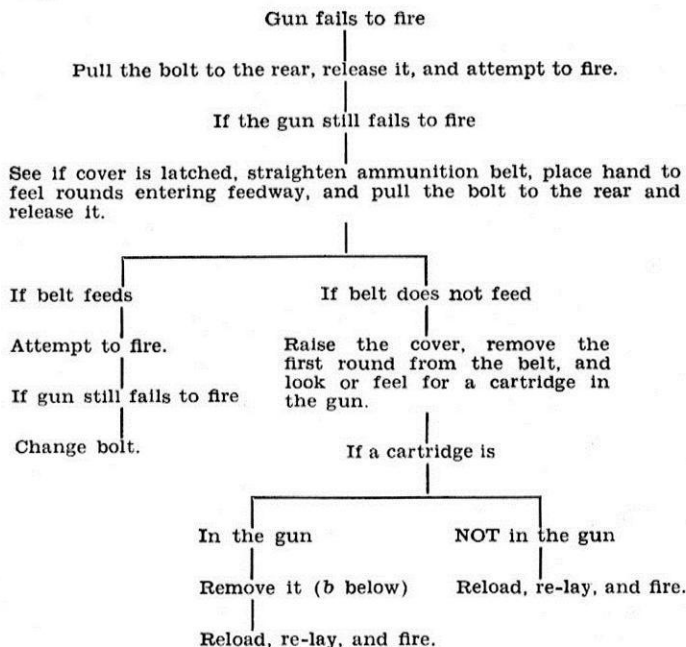
Stoppage	Method of preparation for instruction in immediate action and stoppage
20. Cover extractor spring out or weak.....	20. Remove cover extractor spring.
21. Belt feed lever bent up (stud on lever jumps out of cam groove).	21. Assemble with defective part.
22. Damaged extractor.....	22. Same as 21.
23. Belt holding pawl out or spring weak.	23. Remove belt holding pawl.
24. Broken extractor or ejector.....	24. Assemble bolt with defective part.
25. Broken or damaged T-slot, causing misalignment and buckling of cartridge as bolt moves forward or failure to extract. ¹	25. Do not prepare.
26. Weak ejector spring, causing misalignment and buckling of cartridge as bolt goes forward.	26. Assemble with defective part.
27. Broken barrel extension.....	27. Assemble with defective part.
28. Defective trigger mechanism ¹ ²	28. Do not prepare. ²
29. Defective bolt switch ¹	29. Do not prepare.
30. Bent or broken belt feed pawl arm ¹	30. Do not prepare.

¹ Not prepared for instruction in immediate action.

² Defective trigger mechanism may cause the gun to begin firing as soon as it is loaded or to continue to fire when the trigger is released. To remedy, unlatch the cover or twist the belt, unload, disassemble the gun, and replace defective part or parts.

■ **70. IMMEDIATE ACTION.**—*a.* The procedure prescribed in immediate action for the reduction of stoppages is based on the frequency with which the various types of stoppages occur. Execution of this procedure by the gunner will enable him to remedy the majority of stoppages immediately without attempting to analyze the cause. Immediate action is performed by the gunner. All personnel required to fire the machine gun will be proficient in immediate action. The

procedure for immediate action is shown in the following diagram.



NOTE.—If application of the procedure does not remedy the stoppage, the gunner must examine the feed mechanism and other parts of the gun in order to locate and remedy the trouble.

b. To remove a cartridge from the T-slot, hold back bolt and raise extractor. The cartridge will usually fall out unless it has a thick rim or the T-slot is defective. If cartridge will not fall out when extractor is raised, hold bolt to the rear with extractor raised, place a screw driver or similar tool through top of receiver into top of cannellure of cartridge and drive cartridge downward out of T-slot by striking upper end of screwdriver with the palm of the hand.

c. To remove a case stuck in the chamber, hold back bolt and remove next cartridge from the T-slot. Insert cleaning rod from muzzle and knock empty case from chamber. If

several cases stick in the chamber in close succession, put some oil on chamber cleaning brush, thoroughly scrub chamber with brush, then wipe out chamber with a dry rag.

d. To remove a ruptured case from chamber, use ruptured cartridge extractor, if available. If ruptured case cannot be removed, change barrels.

Caution.—Never attempt to force the bolt forward to remedy a stoppage. After any stoppage which appears to be caused by insufficient recoil, make sure that the bore is clear before continuing firing. It is possible that such a stoppage, as, for instance, one caused by incomplete ignition of the powder charge, may result in the bullet's lodging in the bore, and in case this happens and another round is fired before the bore is cleared the gun will certainly be seriously damaged.

SECTION VII

ADJUSTMENT OF THE M2 MOUNT

■ 71. GENERAL.—The strong recoil and rapid rate of fire of the caliber .50 machine gun cause an intense vibration when the gun is used with the M1 mount. In an effort to reduce this effect, a spring recoil mechanism (par. 72) was incorporated in the M2 mount (see fig. 8). This mechanism is a great assistance to the gunner when it is properly adjusted. When it is not properly adjusted, however, the gunner is subjected to considerable physical shock and is unable to track the target with any accuracy. This mount is equipped with a trigger lever to be used with a side plate trigger. Improper adjustment of this mechanism and of the recoil mechanism has a serious effect on the rate of fire and the size of the cone of fire. Due to the difficulty of making proper adjustments to suit the individual requirements of each gun and the necessity for thorough knowledge of the past performance of the mount, adjustments of the recoil and trigger control mechanisms are made only by designated personnel. Normally they will be made by the chief of section.

■ 72. RECOIL MECHANISM.—a. The recoil mechanism consists of three recoil springs, one component spring, two counter-recoil buffer springs, and related guides, slides, and housings.

The lower recoil spring and the component spring are housed in the lower recoil spring housing, which is located between the side plates at the rear of the cradle. One upper recoil spring and one counterrecoil buffer spring are located in each of two housings on opposite sides of the trunnion bearing at the front of the cradle.

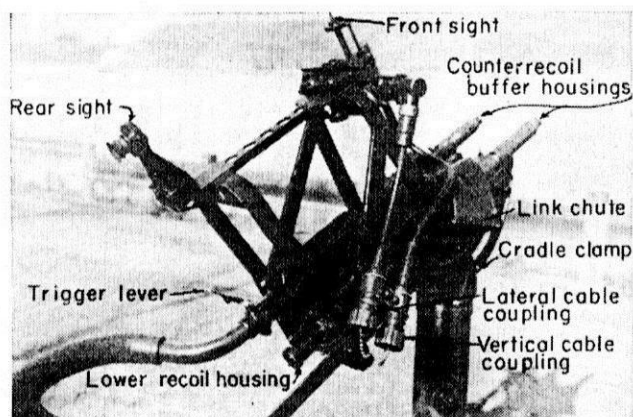


FIGURE 8.—Cradle of M2 mount.

b. As the gun recoils, the trunnion bearing slides and the lower recoil slide move to the rear, compressing all three recoil springs and the component spring. The built-up spring pressure brings the gun to rest and then returns it to battery during counterrecoil. Counterrecoil is checked by the two counterrecoil buffer springs. Except on the last round fired, the buffer springs are aided at the end of counterrecoil by the impulse of recoil from the next round, which occurs when the barrel extension is within approximately 0.12 inch of the trunnion block. The purpose of the component spring is to compensate for the weight component of the gun at different elevations. This is accomplished by a gear and rack arrangement which controls the compression of the spring.

c. (1) *Adjustment of counterrecoil buffer springs* (see fig. 9).—This adjustment is accomplished by means of threaded plugs in the forward part of the spring housings. To adjust

each plug, a lock nut must be loosened, the plug screwed in or out the required amount, and the lock nut tightened. The plug is properly adjusted when its forward face is $6\frac{7}{16}$ inches from the rear face of the housing and the lock nut is locked against it. The housing face referred to is just forward of the trunnion bearing slide. If the plug is screwed in too far, the compression of the spring will be increased, thereby checking the gun too early in counterrecoil and affecting the gun's smoothness of operation. If the plug is unscrewed too far, the smoothness of action is aided, but the danger of metal to metal contact when the gun goes into battery is increased due to the reduced resistance of the buffer springs.

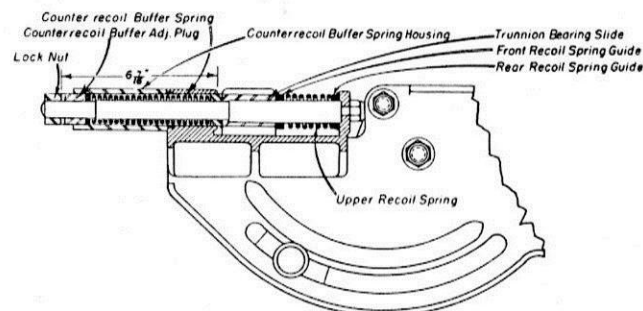


FIGURE 9.—Upper recoil and counterrecoil mechanism.

(2) *Upper recoil springs*.—No adjustment is required. However, the slide guides must be kept lubricated with a light lubricating oil equivalent to SAE 10, 95–115 viscosity at 130° F. (Navy contract #2110). An oil hole is provided in the top of the slide.

(3) *Lower recoil spring* (see fig. 10).—To make this adjustment remove the plate and head at the rear of the housing and withdraw the component spring and component spring rod. Adjustment of the recoil spring is made by means of a nut inside the housing. Screw this nut in or out until its rear face is $4\frac{7}{8}$ inches from rear end of the housing. Care must be taken to see that the measurement is made from the rear face of the nut and not from the bottom of the wrench slot in the nut. This is very important, for if the dis-

tance from the rear face of the nut to the rear of the housing is less than $4\frac{7}{8}$ inches, metal to metal contact may occur on recoil at high elevations. After completing the adjustment, reassemble the component spring and rod and the head and plate. Occasionally the adjusting nut should be unscrewed from the housing and the spring and interior of the housing cleaned. The spring should then be covered with a light grease to prevent corrosion.

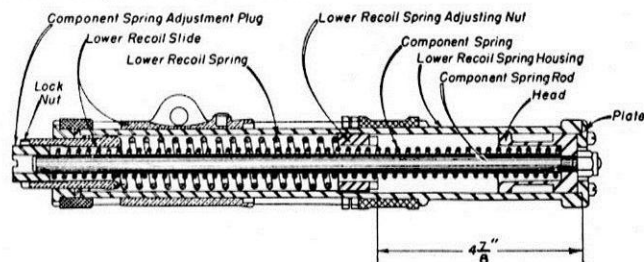


FIGURE 10.—Lower recoil mechanism.

(4) *Component spring* (see fig. 10).—This adjustment is made by means of a plug in the front end of the lower recoil spring housing. The plug is set so that it will be flush with the lock nut when the lock nut is secured. Then the lock nut is tightened and secured by bending the lock washer slightly until it fits into the wrench slot. No further adjustment is required.

(5) *Removal of springs*.—In removing springs care must be taken to prevent injury to personnel. When loosening fittings which hold springs in place, keep personnel not directly engaged in the adjusting operation clear of the path a suddenly released spring might take.

■ 73. TRIGGER CONTROL MECHANISM.—*a.* The trigger control mechanism (see fig. 11) includes a lever, linkage, slide with lug, frame, and three springs. The lever is mounted on a bracket which is clamped to the back rest bracket on the left side of the cradle. The lever is connected through a linkage to the slide which contacts the side plate trigger. The slide and two coil springs are supported by a frame which is attached to the left side frame of the cradle. A torsion spring is attached to the lever.

b. In firing, the gunner pushes the lever down by hand against the action of the torsion spring until it rests against the back rest. This movement of the lever, transmitted through the linkage, pulls the slide to the rear. By contact with a lug on the slide, the side plate trigger slide on the machine gun, which operates the firing mechanism, is also pulled to the rear, causing the gun to fire automatically. A coil spring in the rear part of the slide provides a yielding connection between the lever and the slide to prevent the trigger firing shock from being transmitted to the lever. A coil spring in the front part of the slide and the torsion spring attached to the lever return the mechanism to the disengaged position when the lever is released, causing the side plate trigger slide of the gun to return to its neutral position.

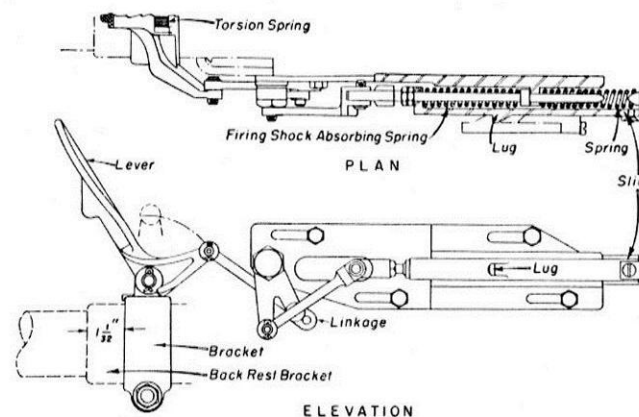


FIGURE 11.—Trigger control mechanism.

c. In assembling the frame of the trigger control mechanism to the cradle side plate, the frame should be so placed that the index line on the upper edge of the frame is opposite the index line on the upper edge of the side plate. If the hand trigger bracket is then secured so that its rear face is $1\frac{1}{32}$ inches from the rear of the back-rest bracket, the various parts of the mechanism will be in the proper relative position. If this position does not permit proper trigger

operation, the frame can be moved to the front or rear not more than one-sixteenth of an inch provided the handle bracket is moved in the same direction an equal distance. Extension of the mechanism will place unnecessary loads on various parts, and contraction of the mechanism will cause loss of part of the lever throw.

SECTION VIII

DISASSEMBLING, ASSEMBLING, AND ADJUSTING THE MACHINE GUN

■ 74. GENERAL.—a. The disassembling, assembling, and adjusting of the machine gun are duties which are performed daily during the care and maintenance of the gun.

b. Removal of groups from the gun is the disassembling of the machine gun into its several part groups (see fig. 12). These groups are the bolt group, oil buffer group (lock frame group in caliber .30), barrel group, cover group, backplate group, and casing and water jacket group. The various part groups may be similarly disassembled into their several parts. This is not normally done except where parts must be repaired or replaced, or before the cleaning and oiling of the component parts.

c. In all disassembling and assembling, proper tools for the performance of the job must be employed. Carelessness on this point can cause considerable damage to the matériel. For field disassembling the combination tool issued with the machine gun is the only tool required. For complete disassembling a pair of pliers and a screw driver of a suitable size will be found convenient.

d. The following paragraphs, except paragraph 86, refer to the caliber .50 machine gun, M2. The corresponding operations for the caliber .50 machine gun, M1921A1, are described in TM 9-226 (now published as TR 1300-50A) and for the caliber .30 machine gun, M1917A1, are described in FM 23-55.

■ 75. REMOVING GROUPS FROM GUN.—The cover may be removed or left assembled to the gun as desired. To remove the cover, release the cover latch and raise the cover. Withdraw the cotter pin from the cover pin. Pull out the cover

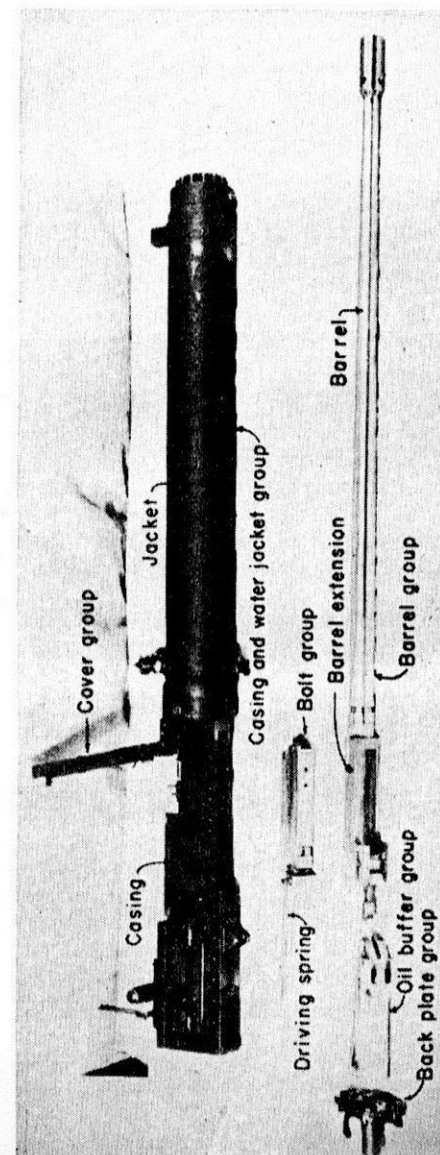


FIGURE 12.—Part groups of caliber .50 machine gun, M2.

pin and remove the cover. Release the backplate latch lock and latch and lift out the backplate. Press forward and away from the side plate on the end of the driving spring rod to release the retaining pin in the head of the rod from the hole in the side plate. Draw the bolt to the rear until the bolt stud can be withdrawn through the opening in the right side of the receiver of the gun. Remove the complete bolt from the rear end of the casing. Compress the oil buffer spring lock, using a cartridge point or the drift on the combination tool inserted through the hole in the right side plate, and remove the oil buffer, barrel extension, and barrel assembly from the rear of the casing. Detach the oil-buffer group from the barrel extension by pressing the accelerator forward.

■ **76. REPLACING GROUPS IN GUN.**—*a.* Lock the oil buffer assembly to the barrel extension by holding the accelerator up under the barrel extension shank, starting the breech lock depressors into the guideways in the barrel extension, and pressing forward, allowing the barrel extension shank to engage in the cross groove of the piston rod. Push forward on the oil buffer until it is fully locked to the barrel extension. Insert the barrel, barrel extension, and oil buffer assembly as a unit into the casing, pushing it forward until the oil buffer spring lock seats in the recess in the right-side plate. Press the cocking lever forward and insert the bolt into the casing, guiding the extractor from the front with the fingers of the left hand to prevent it from catching and the bolt from tripping the accelerator. Insert the bolt stud in the bolt through the enlarged opening in the slot in the right side plate so that the stud collar is inside the side plate, and push the bolt forward. Insert the driving spring rod assembly into the hole in the bolt. Engage the driving spring rod retaining pin in its slot in the right side plate. Replace the backplate. When replacing the backplate, make sure the latch lock is in the unlocked position until the backplate is latched. If the cover has been removed, replace it, inserting the cover pin through the holes in the trunnion block and cover, and locking the cover pin by means of the cotter pin.

b. Head space adjustment.—Head space adjustment is made without removing working parts from the casing. To

head space the caliber .50 M2 gun, screw barrel by hand into barrel extension until it comes into contact with bolt. Check to make sure end of barrel extends through barrel extension. Then unscrew barrel two notches. If gun operates sluggishly, unscrew barrel one additional notch.

NOTE.—1. **HEAD SPACE.**—*a.* The head space of a military weapon with a cartridge fully seated in chamber is the distance between base of cartridge and face of bolt.

b. In Browning machine guns, head space is adjusted by obtaining the proper distance between forward part of bolt and rear end of barrel. Head space adjustment must be checked before firing.

2. **EFFECT OF ADJUSTMENT.**—*a.* Probably the most important adjustment of the machine gun is head space adjustment.

b. Tests show that shot patterns are not adversely affected by the head space when guns are adjusted as outlined above. In fact, better uniformity of shot patterns will be obtained when the guns are operated with the above adjustment which is based on the fundamental design of the weapon. Tests have also proved that guns may be damaged and in some cases put out of action by using unapproved methods of adjusting the head space. Many reports show that difficulties with improperly guided belts and with firing mechanisms have been attributed to undue concern over head space adjustment.

c. Insufficient head space.—When head space adjustment is too tight, poor functioning will result as the breech lock will not fully enter its recess in the bolt. This condition may damage the barrel extension, bolt, or breech lock. Extraction trouble may also occur due to improper timing of locking and unlocking. Furthermore, with a tight head space adjustment the gun operates sluggishly because of the binding of moving parts.

d. Excessive head space.—If the head space is too great, a separation of the cartridge case may occur. Should there be any weakness in the head of the cartridge case, such as a split case, the possibility of a rupture is increased by excessive head space.

■ **77. REPLACING BROKEN OR DAMAGED PARTS.**—Broken or damaged parts will be removed and replaced as soon as possible. Where immediate resumption of fire is essential, a minor part will be replaced by replacing the complete part group in which it is contained. For example, a broken firing pin is replaced by changing bolts and a broken ejector by changing extractors. Where the complete bolt is changed, a check of the head space adjustment must be made. When the action ceases, the broken parts are replaced to make the defective part groups available for use as spares.

■ **78. DETAILED DISASSEMBLING OF BOLT GROUP** (see fig. 13).—The driving spring rod assembly is normally disassembled only when it is necessary to replace the driving spring. To

disassemble it, drive out the collar stop pin from the driving spring rod and remove the collar and the driving spring. Next, disassemble the bolt assembly. Remove the extractor by rotating it upward and pulling it out from the bolt. Do not disassemble the ejector from the extractor unless absolutely necessary. To disassemble the ejector, drive out the ejector pin and remove the ejector and ejector spring. Remove the bolt switch from the bolt.

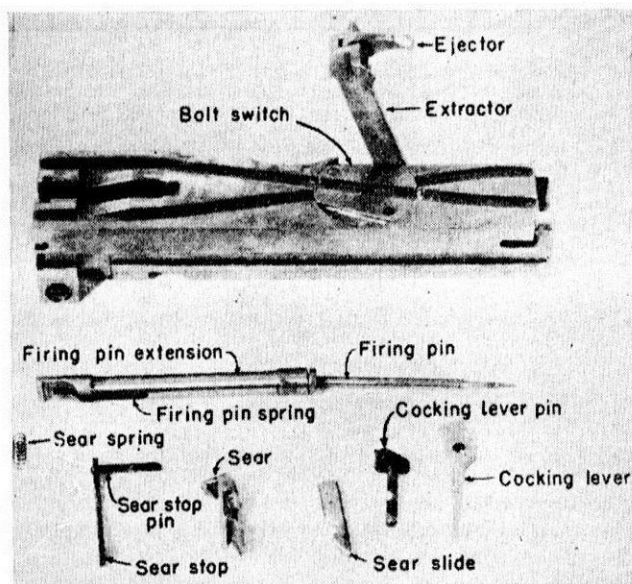


FIGURE 13.—Bolt group.

Rotate the cocking lever fully to the rear and release the firing pin by pushing down the sear. Remove the cocking lever pin and cocking lever. With thin end of the cocking lever, push the sear stop to the right until it is in the center of the slot, then turn the bolt over and push the sear stop out of engagement with the firing pin spring. Reverse the bolt and remove the sear stop from the slot. Remove the sear, sear slide, and sear spring. Elevate the front end of the

bolt, allowing the firing pin extension and firing pin to slide out. The firing pin spring can be removed from the firing pin extension by driving out the firing pin spring stop pin. Take precautions to prevent firing pin spring from flying out during the operation.

■ 79. DETAILED DISASSEMBLING OF OIL BUFFER GROUP (see fig. 14).—Drive out the accelerator pin and remove the accelerator. The remainder of the oil buffer assembly is not disassembled unless absolutely necessary for repairs or replacement. To remove the oil buffer tube, push in on the end of the oil buffer piston rod so that the tube may be gripped by hand and pulled to the rear. The oil buffer spring guide is depressed until it clears the piston rod pin and then is turned until the pin will pass through the slots provided in the guide. Remove the guide and spring.

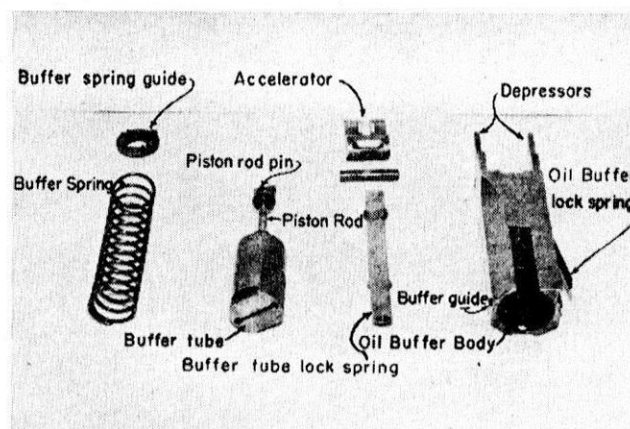


FIGURE 14.—Oil buffer group.

■ 80. DETAILED DISASSEMBLING OF BARREL GROUP (see fig. 15).—Unscrew the barrel from the barrel extension. Remove the barrel-locking spring by sliding it forward out of its seat in the barrel extension. Push out the breech lock pin and remove the breech block.

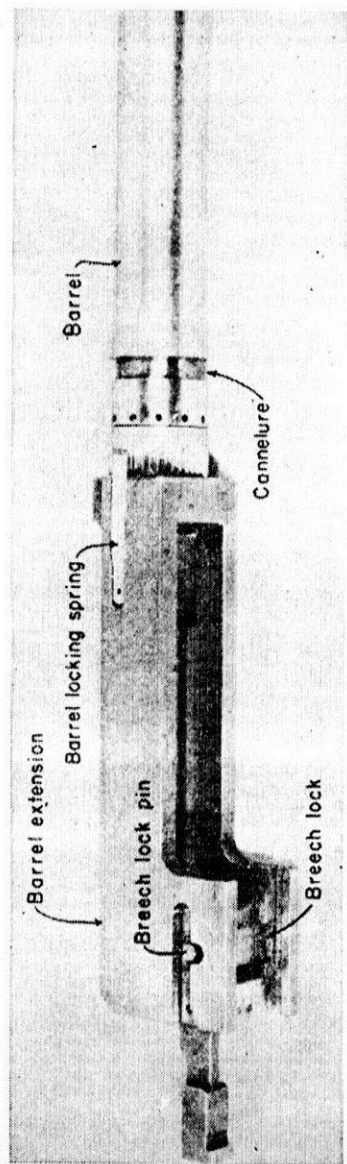


FIGURE 15.—Barrel group.

■ 81. DETAILED DISASSEMBLING OF COVER GROUP (see fig. 16).— Remove the cover as described in paragraph 75. Withdraw the belt feed lever pivot stud cotter pin and pry the belt feed lever off its stud, taking care that the lever plunger and spring do not fly out. In the removal of the belt feed lever the toe of the lever must be in line with the slot in the cover to withdraw it. Remove the belt feed slide and drive out the belt feed pawl pin. This allows the belt feed pawl, spring, and pawl arm to be separated. Drive out the cover latch pin and remove the cover latch. Remove the cover latch spring by lifting its front end out of the slot in the cover and sliding it forward. Remove the cover extractor spring by releasing its rear end from its seat in the cover extractor cam and sliding it to the rear.

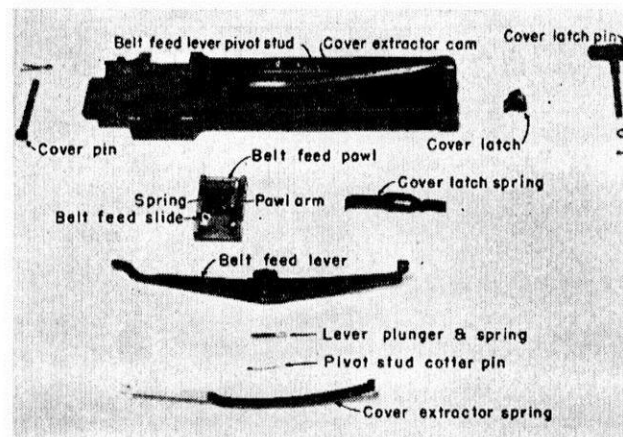


FIGURE 16.—Cover group.

■ 82. DETAILED DISASSEMBLING OF BACKPLATE GROUP (see fig. 17).—a. Drive out the backplate latch pin and remove the backplate latch and backplate latch spring, taking care that the spring does not fly out when the latch is removed. Drive out the latch lock pin and remove the latch lock, latch lock spacers, and latch lock spring. Drive out the trigger pin, being careful that the trigger spring does not fly out upon removal of the trigger.

b. The adjusting screw, buffer disks, and buffer plate are not removed except for repair or adjustment. If it is necessary to remove these parts, unscrew the adjusting screw and remove the adjusting screw plunger and the adjusting screw plunger spring. Remove the buffer disks and the buffer plate through the rear end of the buffer tube.

c. When the backplate group is fully assembled, the adjusting screw must always be kept screwed tight against the buffer disks. If the top of the adjusting screw becomes flush with the end of the buffer tube when screwed tight, remove the adjusting screw and add one or more buffer disks.

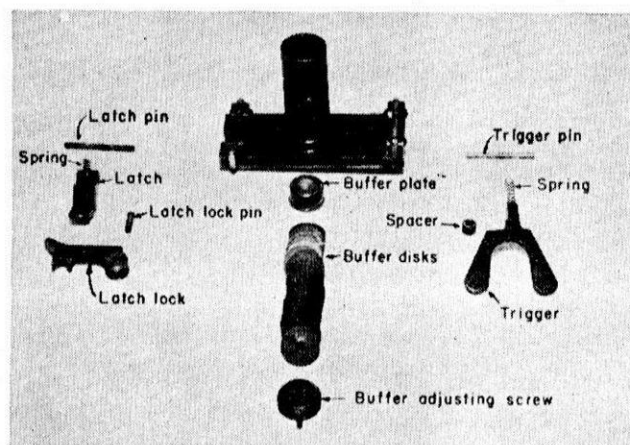


FIGURE 17.—Backplate group.

■ 83. DETAILED DISASSEMBLING OF CASING AND WATER JACKET GROUP (see fig. 18).—a. To remove the *side plate trigger assembly* from the casing, withdraw the cotter pin from the side plate trigger bolt and unscrew the side plate trigger nut. To disassemble the assembly, unscrew the side plate trigger extension screw, lift off the side plate trigger extension, and remove the side plate trigger slide spring. Push the side plate trigger slide out of its guides in the housing. Swing the side plate trigger cam upward and lift out the side plate trigger spring. The side plate trigger cam can be removed

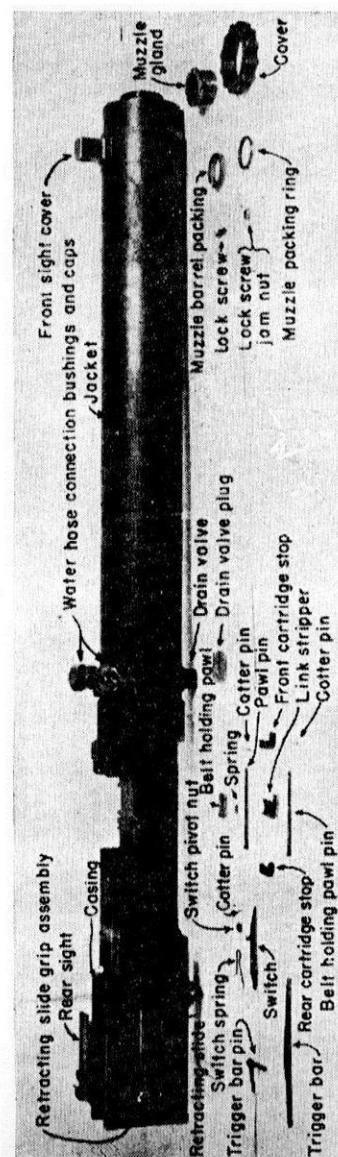


FIGURE 18.—Casing and water jacket group.

by driving out the side plate trigger pin, but this is not done unless necessary for replacement of the cam.

b. To remove the *retracting slide assembly* from the casing, pull out the locking wires and unscrew the retracting slide bracket screws. To disassemble the assembly, withdraw the cotter pin from the retracting slide bracket bolt, unscrew the retracting slide nut, and remove the bolt from the retracting slide bracket. Withdraw the cotter pin from the retracting slide lever stud, unscrew the retracting slide nut, and remove the washer. Remove the retracting slide lever and the grip assembly from the lever stud. Remove the lever spring. Remove the retracting slide from the retracting slide bracket. Unscrew the retracting slide lever stop from the retracting slide.

c. To remove the *trigger bar* from the casing, lift the end of the trigger bar pin lock from its seat in the side plate, rotate downward about 90°, and pull out the trigger bar pin.

d. To remove the *switch* and *switch spring*, withdraw the cotter pin and unscrew the switch pivot nut.

e. To remove the *belt-holding pawl*, draw the pawl pin out to the rear, taking care that the belt-holding pawl spring does not fly out upon removal of the pawl.

f. To remove the *link stripper* and the *front and rear cartridge stops*, draw the belt-holding pawl pin located on the opposite side of the feedway from the belt-holding pawl to the rear.

g. To remove the *trunnion block lock and spring*, withdraw the cotter pin from the lock.

h. To remove the *cover detent pawl and spring*, withdraw the cotter pin from the pawl.

i. Unscrew the front barrel bearing lock screw jam nut and front barrel bearing lock screw. The *muzzle gland*, the *muzzle packing ring*, and the *muzzle barrel packing* may then be removed. This is not recommended unless necessary for repair or to repack the barrel.

■ 84. SEQUENCE IN ASSEMBLING.—a. In general, the groups are assembled and replaced in the gun in the reverse order to that in which they are removed and disassembled. There are certain precautions in connection with assembling which

are outlined below and must be observed in order that the parts may be placed in the gun and in order that they may function properly after the gun is assembled. In most cases, if the gun can be assembled failure to observe these points will result in failure of the bolt to go fully forward on the closing movement.

b. Be sure that in assembling the part groups they are all properly assembled either for a left hand or right hand feed. The following instructions are for assembly for *left hand feeding*.

(1) The cam groove in the *bolt switch* must line up with the cam groove in the bolt marked *L*. If it is opposite the groove marked *R*, lift up the bolt switch high enough to be clear of the bolt switch stud and rotate it one-half turn so that the stud enters the opposite hole in the switch.

(2) When the cover is raised, the upper end of the *belt feed lever* is toward the left side of the cover and the *belt feed pawl arm* points toward the right and is on the upper side of the pawl.

(3) The *front and rear cartridge stops* and the *link stripper* are assembled on the right side of the feedway, and the *belt-holding pawl* on the left side of the feedway.

c. In assembling the barrel extension, make sure that the *breech lock* is inserted with the bevel faces to the front and the double bevel on top.

d. The *accelerator* is assembled in the oil buffer body with the accelerator tips up and rounded surface to the front.

e. The *cocking lever* is assembled in the bolt with the rounded nose on the lower end of the lever to the rear of the bolt so that it will properly engage the rear of the slot in the firing pin extension.

f. In assembling the *fiber buffer disks*, be sure that they are clean and free of rough edges and surfaces. Assemble them in the tube one at a time, firmly seating each disk and using sufficient disks so that when the adjusting screw is inserted and tightened, its outer face will extend slightly outside the backplate.

g. When *reassembling the backplate to the gun*, keep the latch lock in the unlocked position until the backplate is latched.

■ **85. ADJUSTMENT OF OIL BUFFER.**—The rate of fire of the caliber .50 machine gun is controlled by adjustment of the oil buffer. This is accomplished by inserting a screw-driver blade into the slot in the rear of the oil buffer tube through the hole in the backplate and rotating the tube the required number of clicks in the proper direction. Turning the tube clockwise reduces the rate of fire, and turning it counter-clockwise increases the rate of fire. The buffer tube is held in an adjusted position by the buffer tube lock spring.

■ **86. ATTACHMENT OF FLASH HIDERS.**—*a. Flash hid*ers are not used on the caliber .50 machine gun. Two types of flash hiders are provided for the caliber .30 machine gun, the M1917 and the M1923.

b. To attach the M1917 flash hider, the spring plate is slipped over the muzzle gland and given one quarter of a turn in either direction. This brings the lugs on the spring plate in line with corresponding indentations in the gun side of the muzzle gland. These lugs, under the action of the spring formed by the cupping of the spring plate, then click into place and prevent rotation of the flash hider. A flash hider is not used unless it has been inspected and found to be in satisfactory condition. In inspecting the flash hider, see that all rivets are tight, that the spring plate, particularly the cupped position, is not distorted, and that the small lugs on the spring plate are not so worn that the flash hider is loose when the lugs are engaged in the indentations on the muzzle gland. After the flash hider is attached, it is examined to insure that it is firmly in position.

c. To attach the M1923 flash hider, remove the muzzle gland and with the barrel packing properly in place, slide the flash hider over the muzzle of the barrel. Screw the flash hider tightly into the end cap. While the flash hider is attached to the gun, a threaded projection formed on the rear end of the flash hider serves as the muzzle gland.

SECTION IX

CARE AND MAINTENANCE

■ **87. GENERAL.**—It is essential that the gun and mount are maintained at all times in the best possible condition. They must always be kept clean and all unpainted parts covered with a light coating of oil. Accessories and ammunition must also be given careful attention. All parts of the gun are cleaned daily immediately after firing for the day is ended. The guns are also cleaned for about 1 week after all firing is completed, the cleaning being repeated daily until sweating has ceased. Particular care must be employed in damp climates, during damp or rainy weather, or when the matériel is used at night.

■ **88. CLEANING BORE.**—*a.* The barrel is the part of the machine gun requiring the most careful attention. To clean powder fouling from the barrel, the gun is disassembled. The barrel is placed muzzle down in a vessel containing hot water and issue soap, a solution of soda ash, hot water, or, in the absence of these, cold water. Normally hot water will be available from the water pump. Insert a suitable cleaning rod, with a cleaning patch attached, into the breech and pump the cleaning solution back and forth through the bore for about 1 minute. While the bore is wet, run a brass or bronze wire brush, if available, all the way through the bore, then all the way back, three or four times. Then pump the water solution through the bore again. Wipe the cleaning rod dry, remove the barrel from the water, and thoroughly dry the bore and chamber, using clean, dry flannel patches. Apply a light coat of lubricating oil. Inspect daily and repeat above treatment until bore shows no signs of corrosion.

b. The soda-ash solution is prepared by dissolving ½ to 1 pound, depending upon the strength desired, of soda ash (sodium carbonate cleaning compound—calcined soda) in 1 gallon of boiling water. The soda ash stands storage very well if kept dry. The solution is prepared at the time it is to be used.

■ 89. **CLEANING REMAINDER OF GUN.**—The receiver is wiped clean, particular care being taken to remove dirt and lint from the belt-holding pawl. Then the various parts of the gun and the part groups are wiped clean, a small stick covered with a flannel patch being used to remove dirt from all recesses. The water jacket is wiped clean and the muzzle gland is tightened and repacked, if necessary. After cleaning, all parts are wiped with an oily rag. At the end of the firing season, or oftener where weather conditions or prolonged action require it, the various part groups are completely disassembled and all component parts cleaned and oiled.

■ 90. **CLEANING MOUNT.**—For the M1 mount, keeping the parts of the mount free of dirt and grit and exposed metal surfaces and moving parts lubricated with oil is all that is necessary. For the M2 mount, in addition the various parts of the trigger control and recoil mechanisms must be carefully cleaned and oiled periodically. A light lubricating oil, such as Navy contract #2110 (SAE 10), is used. This oil is used to lubricate the slides of the recoil mechanism every 2 hours of *continuous* firing. The elevating and traversing screws of the front sight mechanisms are lubricated with a few drops of oil once a day. When assembling the mount, contact surfaces to be assembled must be cleaned and all screw fastenings oiled to facilitate assembly and disassembly and to prevent corrosion.

■ 91. **LUBRICATION BEFORE FIRING.**—Proper oiling is second in importance only to intelligent cleaning. Oil all bearing surfaces of the gun with aircraft machine-gun lubricating oil before firing, taking particular care to see that the exterior of the barrel is oiled at the breech end. Oil the cover extractor spring, the cover extractor cam, the cocking lever, the belt feed lever groove in the bolt, the grooves in the barrel extension to take the bolt ribs, the breech lock cam, the switch, and the ways of the belt feed slide.

■ 92. **FILLING OIL BUFFER.**—Remove the filling screws from the base of the oil buffer tube. Use the oil buffer filling oiler filled with a machine-gun recoil oil. In an emergency any light recoil oil may be used, adding glycerin, if necessary.

during freezing weather. Have the oil flowing freely before the nozzle is inserted in the filling hole, and keep the oil flowing until the nozzle is withdrawn to prevent admitting air bubbles into the buffer tube. Repeat the operation until the buffer is overflowing. Replace the filling screws. Any excess oil in the buffer will be relieved by the relief valve in the forward end of the buffer body. Two filling holes are provided to show visually by overflow when the buffer tube is completely full and to prevent the formation of an air pocket within the tube.

■ 93. **PACKING BARREL.**—*a.* As the barrel moves during the action of recoil, it is necessary to provide a *special packing* at the breech and muzzle ends to prevent leakage of water from the water jacket. Formed barrel packings are inserted in the cannellure at the rear end of the barrel and inside the front end of the water jacket.

b. The machine gun being disassembled, to pack the *breech end* of the barrel, unscrew the packing adjusting ring and remove the old rear barrel packing from the cannellure. Clean the cannellure and insert the new rear barrel packing. Smooth the packing until the ends meet. Screw the packing adjusting ring against the packing to hold it in place. For proper functioning, the packing must be flush with the surface of the barrel. If the packing appears to be too thick, insert the breech end of the barrel into the hole in the trunnion blocks, push forward gently, and twist the barrel until the packing is worked down to fit.

c. To pack the *muzzle end* of the barrel, unscrew the front barrel bearing lock screw jam nut and the front barrel bearing lock screw. Unscrew and remove the muzzle gland. Remove the muzzle packing ring and the old front barrel packing. Clean out the inside of the front barrel bearing, insert the new front barrel packing, and replace the muzzle packing ring and muzzle gland. Screw the muzzle gland lightly against the ring and packing as the gland will be adjusted and locked in place after the barrel is reassembled in the gun.

d. Reassemble the barrel assembly into the gun, being careful not to injure the barrel packing. Adjust the muzzle packing by tightening or loosening the muzzle gland, and

then lock in place with the front barrel bearing lock screw and jam nut. Adjust the breech packing by tightening or loosening the packing adjusting ring, using a packing ring adjusting wrench and a barrel-holding wrench. Test the free movement of the recoiling parts of the gun by pulling and releasing the bolt several times. If there is too much friction, work the bolt until the barrel moves forward and rearward smoothly.

■ 94. CHANGING BARREL.—*a.* To change the barrel, open the drain valve and drain the water from the water jacket into the water chest. Disassemble the gun. See that the breech packing on the new barrel is in good condition. Unscrew the old barrel from the barrel extension and replace it with the new barrel, being careful to secure the proper head space adjustment. Reassemble the gun. In removing and assembling the barrel, care must be exercised to avoid disarranging the muzzle packing. Close the drain valve and refill the water jacket. Adjust the breech and muzzle packings, if necessary.

b. The normal method of changing the barrel is described in *a* above. However, in certain cases the necessity for saving time may require the changing of the barrel without draining the water from the water jacket. *To retain the water in the water jacket* while the barrel is being replaced, certain changes in the procedure are necessary. Do not open the drain valve. Remove the backplate, bolt, and driving spring assemblies. Screw the union caps to the inlet and outlet openings of the water jacket and lower the muzzle of the gun to prevent the loss of water at the breech end. Complete the disassembling of the gun. As the barrel is withdrawn, follow it with a plug and insert the plug in the hole in the muzzle gland. Place a plug or twisted patch in the muzzle of the new barrel. Replace the barrel as in *a* above and assemble the barrel, barrel extension, and oil buffer in the gun. As the barrel passes through the hole in the muzzle gland, remove the plug in the hole. Remove the plug in the barrel and run a clean patch through the barrel. Complete the assembly of the gun. Adjust the breech and muzzle packings, if necessary.

■ 95. INSPECTING BARREL FOR SERVICEABILITY.—*a.* The accuracy life of a machine-gun barrel depends largely on the number of rounds fired and the rate of fire. Methods for determining the relative accuracy of different barrels were discussed in paragraph 22. This paragraph is concerned with suitable methods to be employed in determining when a barrel is too inaccurate for further use.

b. Visual inspection is the method of barrel inspection authorized for the using service. Barrels must be visually inspected frequently to prevent their use after they have become unserviceable. Before attempting to inspect a barrel for serviceability, remove all fouling and wipe the bore dry. Having cleaned the barrel, hold it so that its interior is lighted, and examine the bore from the breech end. If the lands are worn away at the breech end so that about the first 6 inches of the bore are smooth, the barrel will be considered unserviceable.

c. If in making the test with the bullet described in paragraph 22 the distance from the rear of the bullet to the rear of the barrel exceeds 6 inches for the caliber .50 barrel or 3 inches for the caliber .30 barrel, that barrel should not be used for further firing unless absolutely necessary. Such barrels should be placed with barrels found unserviceable by visual inspection and submitted for inspection by an ordnance inspector.

d. Unserviceable barrels will be tagged "Unserviceable—Do not use," and will be held for final disposition by an ordnance inspector.

■ 96. PRECAUTIONS TO BE OBSERVED IN COLD WEATHER.—*a.* See that the water in the cooling system does not freeze. In locations where the atmospheric temperature is frequently below 32° F., it is necessary to have an antifreeze mixture of some kind available that can be used in the water jacket that will not freeze nor gum and yet will cool the barrel. It has been found that automotive crank case oil drainings are excellent for this purpose and their use is authorized. It must be remembered that this mixture cannot be used satisfactorily where the atmospheric temperature is in excess of 32° F. No circulating unit or steam-condensing device is necessary

when oil drainings are used in the water jacket, but the outlet hole must be uncovered before the gun is fired.

b. Test the gun frequently to see that it functions properly.

c. During cold weather when the gun is silent, the movable parts in the receiver of the gun must be kept absolutely dry and free from oil, but before the gun is fired the moving parts should be oiled.

■ 97. PRECAUTIONS DURING AND AFTER GAS ATTACK.—a. Cover the gun with a waterproof covering, if available, *during the attack*. If the gun is not being fired, the recoiling parts are operated by hand.

b. Immediately *after the attack*, clean the gun. All metal parts are cleaned in boiling water containing a little soda. The gun is then dried and oiled. Oil will prevent corrosion for about 12 hours. All traces of gas must be removed from ammunition with a slightly oiled rag. The ammunition is then thoroughly dried.

c. Where circumstances permit its use, *rust-preventive compound* will be found to resist gas corrosion more than a lighter oil.

CHAPTER 4
DRILL TABLE

Drill of the antiaircraft machine-gun squad¹

De- tails	PREPARE FOR ACTION ²	EXAMINE GUNS ³	(a) LOAD (b) TARGET ⁴	COMMENCE FIRING	(a) SUSPEND FIRING ⁵ (b) CEASE FIRING ⁵	MARCH ORDER ¹
No. 1	<i>Drill A.</i> —Assisted by No. 3, he removes the ammunition chest from the mount and the link bag from the link chute, dismounts the gun, passes the gun off the rear of the truck to No. 2, removes the cradle, and carries the cradle to the gun position, following No. 2. When the pedestal and legs are assembled, he mounts the cradle, assisted by No. 3. Then, assisted by No. 2, he mounts the gun, bore-sights the gun, if necessary, and aids the platoon headquarters and range section in attaching the central control cables, if used. He takes post in rear of the gun. <i>Drill B.</i> —Assisted by No. 3, he removes the ammunition chest from the mount, dismounts the gun, and passes the gun off the rear of the truck to No. 2. When the yoke has been removed, Nos. 4 and 5 assist No. 1 in folding up the tripod, removing it from the truck, and carrying it, behind No. 3, to the position. Upon arrival at the position, No. 1, assisted by Nos. 4 and 5, sets up the tripod. He then mounts the gun with the assistance of No. 2. He takes post in rear of the gun.	He sees that the gun mechanism and the mount are in good working order and adjustment, that the sighting mechanism, if used, operates properly, and that the gun elevates and traverses freely. He then reports, "Gun and mount in order."	(a) At the command LOAD, as soon as the ammunition belt is fed into the receiver, he pulls the bolt to the rear twice. (b) At the command TARGET, he begins to track the target by traversing and elevating or depressing the gun and then calls out, "On target."	He continuously presses the trigger, and tracks the target with his sights (central control) or with the aid of tracers (individual tracer control). If stoppages occur, he clears them with the aid of Nos. 2 and 3.	(a) At the command SUSPEND FIRING, he releases the trigger and continues to track the target. (b) At the command CEASE FIRING, he releases the trigger and stops tracking the target. With the aid of No. 2, he unloads the gun.	<i>Drill A.</i> —Assists the platoon headquarters and range section in detaching the central control cables, if used. Assisted by No. 3, removes the ammunition chest from the mount, dismounts the gun, passes the gun to No. 2, removes the cradle, and carries the cradle to the truck, following No. 4. When the pedestal and legs are assembled, he mounts the cradle, assisted by No. 3. He then mounts the gun, assisted by No. 2. He takes post in the truck convenient to the gun. <i>Drill B.</i> —Assisted by No. 3, removes the ammunition chest from the mount, dismounts the gun, and passes the gun to No. 2. When the yoke has been removed, he is assisted by Nos. 4 and 5 in folding up the tripod, removing it to the truck following the squad leader, and setting it up in the truck. He then mounts the gun, assisted by No. 2. He then takes post in the truck convenient to the gun.
No. 2	<i>Drill A.</i> —He jumps off the truck, receives the gun from Nos. 1 and 3, and proceeds to the gun position. When the cradle is mounted, he assists No. 1 in mounting the gun and bore-sighting the gun, if necessary, and aids in the attachment of the central control cables, if used. He then assists Nos. 3 and 4 in bringing up the remaining equipment. He takes post on the left of the gun and facing it. <i>Drill B.</i> —He jumps off the truck, receives the gun from Nos. 1 and 3, and proceeds to the position. When the yoke is mounted, he assists No. 1 in mounting the gun. He then assists Nos. 3 and 4 in bringing up the remaining equipment. He takes post on the left of the gun and facing it.	He sees that there is one ammunition chest on the gun and that a full ammunition chest is located convenient to the gun. When no firing is to occur, he sees that there is no live ammunition near the gun. He then reports, "Ammunition in order."	(a) At the command LOAD, he opens the ammunition chest and feeds the end of the ammunition belt into the receiver until one round is beyond the belt-holding pawl. (b) At the command TARGET, he shifts his post to conform to the movement of the gun.	If stoppages occur, he assists Nos. 1 and 3 in clearing them. Assisted by No. 5, he replaces the ammunition chest on the gun with additional chests as required.	(a) Same as under TARGET. (b) When the cradle is clamped, he assists No. 1 in unloading the gun. He replaces the belt in the ammunition chest and closes the top of the chest. He replaces the ammunition chest, if necessary.	<i>Drill A.</i> —Assists the platoon headquarters and range section in detaching the central control cables, if used. He receives the gun from Nos. 1 and 3. When the mount is disassembled, he follows Nos. 1 and 3 to the truck. When the mount is assembled in the truck he assists No. 1 in mounting the gun. He then assists Nos. 3 and 4 in bringing up the remaining equipment from the position to the truck. He takes post on the truck as directed by the squad leader. <i>Drill B.</i> —This drill is the same as drill A except that he follows No. 3 in carrying the gun to the truck.
No. 3	<i>Drill A.</i> —He assists No. 1 in removing the ammunition chest from the mount and the link bag from the link chute, dismounting the gun, passing the gun to No. 2, dismounting the cradle, carrying the cradle to the position, and mounting the cradle. He then returns to the truck for an ammunition chest and the link bag, carries them to the position, and attaches them to the mount. He assists Nos. 2 and 4 in carrying the remaining equipment to the position. He then takes post on the right of the gun and facing it. <i>Drill B.</i> —He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, and passing the gun to No. 2. He dismounts the yoke and follows No. 2 to the position. When the tripod is set up, he mounts the yoke. He then returns to the truck for an ammunition chest, carries it to the position, and attaches it to the mount. He assists Nos. 2 and 4 in carrying the remaining equipment to the position. He then takes post on the right of the gun and facing it.	He checks the cables, if used, to see that there are no kinks and that there is sufficient slack. He then reports, "Cables in order."	(a) At the command LOAD, he raises the cover and then unclamps the cradle. When No. 2 has fed the ammunition belt into the receiver, he lowers the cover. When loading the caliber .30 gun, he assists in loading by pulling on the brass tab of the belt until the first round is engaged. (b) At the command TARGET, he shifts his post to conform to the movement of the gun.	If stoppages occur, he assists Nos. 1 and 2 in clearing them. He removes, empties, and replaces the link bag when necessary.	(a) Same as under TARGET. (b) When No. 1 stops tracking, No. 3 clamps the cradle. He removes the link bag, empties the links into a suitable receptacle, and then replaces the link bag. He collects the empty cartridges and places them in suitable receptacles.	<i>Drill A.</i> —He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, passing the gun to No. 2, dismounting the cradle, carrying the cradle to the truck, and mounting the cradle. He then returns to the position to assist Nos. 2 and 4 in carrying the remainder of the equipment to the truck. He takes post on the truck as directed by the squad leader. <i>Drill B.</i> —He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, and passing the gun to No. 2. He dismounts the yoke, follows Nos. 1, 4, and 5 to the truck, and when the tripod is set up, mounts the yoke. He then returns to the position to assist Nos. 2 and 4 in carrying the remainder of the equipment to the truck. He takes post on the truck as directed by the squad leader.
No. 4	<i>Drill A.</i> —He disconnects the water hoses and coils them on the water chest. Assisted by No. 5, he removes the legs from the pedestal. He takes the pedestal off the rear of the truck and follows Nos. 1 and 3 to the gun position. Assisted by No. 5, he assembles the pedestal and legs. He returns to the truck for the water chest and hoses, carries them to the position, assisted by No. 5, and connects the water hoses to the position. He then assists Nos. 2 and 3 in carrying the remaining equipment to the position. He takes post at the water pump. <i>Drill B.</i> —He disconnects the water hoses and coils them on the water chest. He assists Nos. 1 and 5 in folding up the tripod, removing it from the truck, carrying it to the position, and setting it up. He returns to the truck for the water chest and hoses and, assisted by No. 5, carries them to the position. He then connects the water hoses to the gun. He assists Nos. 2 and 3 in carrying the remaining equipment to the position.	He sees that the water jacket is filled, that all water plugs and hose connections are tight, and that the water chest is filled and in working order. He also sees that a full water container is conveniently located. He then reports, "Water pump in order."	(a) He remains at the water pump. (b) If necessary, he shifts the position of the water chest to avoid being in front of the muzzle when fire is commenced.	He continuously operates the water pump.	(a) Continues to operate the water pump. (b) Continues to operate the water pump for about 20 full turns of the pump handle after the gun ceases firing. If necessary, he changes the water in the water chest.	<i>Drill A.</i> —He disconnects the water hoses and coils them on the water chest. Assisted by No. 5, he removes the legs from the pedestal. He then carries the pedestal to the truck, following No. 5. With the aid of No. 5, he assembles the pedestal and legs. He returns to the position for the water chest and hoses, carries them to the truck, and connects the water hoses to the gun. He then returns to the position to assist Nos. 2 and 3 in carrying the remainder of the equipment to the truck. He takes post on the truck convenient to the water pump. <i>Drill B.</i> —He disconnects the water hoses and coils them on the water chest. He assists Nos. 1 and 5 in folding up the tripod, removing it to the truck, and setting it up in the truck.

No. 1	<i>Drill A.</i>—Assisted by No. 3, he removes the ammunition chest from the mount, dismounts the gun, passes the gun off the rear of the truck to No. 2, removes the cradle, and carries the cradle to the gun position, following No. 2. When the pedestal and legs are assembled, he mounts the cradle, assisted by No. 3. Then, assisted by No. 2, he mounts the gun, bore-sights the gun, if necessary, and aids the platoon headquarters and range section in attaching the central control cables, if used. He takes post in rear of the gun. <i>Drill B.</i>—Assisted by No. 3, he removes the ammunition chest from the mount, dismounts the gun, and passes the gun off the rear of the truck to No. 2. When the yoke has been removed, Nos. 4 and 5 assist No. 1 in folding up the tripod, removing it from the truck, and carrying it, behind No. 3, to the position. Upon arrival at the position, No. 1, assisted by Nos. 4 and 5, sets up the tripod. He then mounts the gun with the assistance of No. 2. He takes post in rear of the gun.	He sees that the gun mechanism and the mount are in good working order and adjustment, that the sighting mechanism, if used, operates properly, and that the gun elevates and traverses freely. He then reports, "Gun and mount in order."	(a) At the command LOAD, as soon as the ammunition belt is fed into the receiver, he pulls the bolt to the rear (b) At the command TARGET, he begins to track the target by traversing and elevating or depressing the gun and then calls out, "On target."	He continuously presses the trigger, and tracks the target with his sights (central control) or with the aid of tracers (individual tracer control). If stoppages occur, he clears them with the aid of Nos. 2 and 3.	(a) At the command SUSPEND FIRING, he releases the trigger and continues to track the target. (b) At the command CEASE FIRING, he releases the trigger and stops tracking the target. With the aid of No. 2, he unloads the gun.	<i>Drill A.</i>—Assists the platoon headquarters and range section in detaching the central control cables, if used. Assisted by No. 3, removes the ammunition chest from the mount, dismounts the gun, passes the gun to No. 2, removes the cradle, and carries the cradle to the truck, following No. 4. When the pedestal and legs are assembled, he mounts the cradle, assisted by No. 3. He then mounts the gun, assisted by No. 2. He takes post in the truck convenient to the gun. <i>Drill B.</i>—Assisted by No. 3, removes the ammunition chest from the mount, dismounts the gun, and passes the gun to No. 2. When the yoke has been removed, he is assisted by Nos. 4 and 5 in folding up the tripod, removing it to the truck following the squad leader, and setting it up in the truck. He then mounts the gun, assisted by No. 2. He then takes post in the truck convenient to the gun.
No. 2	<i>Drill A.</i>—He jumps off the truck, receives the gun from Nos. 1 and 3, and proceeds to the gun position. When the cradle is mounted, he assists No. 1 in mounting the gun and bore-sighting the gun, if necessary, and aids in the attachment of the central control cables, if used. He then assists Nos. 3 and 4 in bringing up the remaining equipment. He takes post on the left of the gun and facing it. <i>Drill B.</i>—He jumps off the truck, receives the gun from Nos. 1 and 3, and proceeds to the position. When the yoke is mounted, he assists No. 1 in mounting the gun. He then assists Nos. 3 and 4 in bringing up the remaining equipment. He takes post on the left of the gun and facing it.	He sees that there is one ammunition chest on the gun and that a full ammunition chest is located convenient to the gun. When no firing is to occur, he sees that there is no live ammunition near the gun. He then reports, "Ammunition in order."	(a) At the command LOAD, he opens the ammunition chest and feeds the end of the ammunition belt into the receiver until one round is beyond the belt-holding pawl. (b) At the command TARGET, he shifts his post to conform to the movement of the gun.	If stoppages occur, he assists Nos. 1 and 3 in clearing them. Assisted by No. 5, he replaces the belt in the ammunition chest on the gun with additional chests as required.	(a) Same as under TARGET. (b) When the cradle is clamped, he assists No. 1 in unloading the gun. He replaces the belt in the ammunition chest and closes the top of the chest. He replaces the ammunition chest, if necessary.	<i>Drill A.</i>—Assists the platoon headquarters and range section in detaching the central control cables, if used. He receives the gun from Nos. 1 and 3. When the mount is disassembled, he follows Nos. 1 and 3 to the truck. When the mount is assembled in the truck he assists No. 1 in mounting the gun. He then assists Nos. 3 and 4 in bringing up the remaining equipment from the position to the truck. He takes post on the truck as directed by the squad leader. <i>Drill B.</i>—This drill is the same as drill A except that he follows No. 3 in carrying the gun to the truck.
No. 3	<i>Drill A.</i>—He assists No. 1 in removing the ammunition chest from the mount and the link bag from the link chute, dismounting the gun, passing the gun to No. 2, dismounting the cradle, carrying the cradle to the position, and mounting the cradle. He then returns to the truck for an ammunition chest and the link bag, carries them to the position, and attaches them to the mount. He assists Nos. 2 and 4 in carrying the remaining equipment to the position. He then takes post on the right of the gun and facing it. <i>Drill B.</i>—He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, and passing the gun to No. 2. He dismounts the yoke and follows No. 2 to the position. When the tripod is set up, he mounts the yoke. He then returns to the truck for an ammunition chest, carries it to the position, and attaches it to the mount. He assists Nos. 2 and 4 in carrying the remaining equipment to the position. He then takes post on the right of the gun and facing it.	He checks the cables, if used, to see that there are no kinks and that there is sufficient slack. He then reports, "Cables in order."	(a) At the command LOAD, he raises the cover and then unclamps the cradle. When No. 2 has fed the ammunition belt into the receiver, he lowers the cover. When loading the caliber .30 gun, he assists in loading by pulling on the brass tab of the belt until the first round is engaged. (b) At the command TARGET, he shifts his post to conform to the movement of the gun.	If stoppages occur, he assists Nos. 1 and 2 in clearing them. He removes, empties, and replaces the link bag when necessary.	(a) Same as under TARGET. (b) When No. 1 stops tracking, No. 3 clamps the cradle. He removes the link bag, empties the links into a suitable receptacle, and then replaces the link bag. He collects the empty cartridges and places them in suitable receptacles.	<i>Drill A.</i>—He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, passing the gun to No. 2, dismounting the cradle, carrying the cradle to the truck, and mounting the cradle. He then returns to the position to assist Nos. 2 and 4 in carrying the remainder of the equipment to the truck. He takes post on the truck as directed by the squad leader. <i>Drill B.</i>—He assists No. 1 in removing the ammunition chest from the mount, dismounting the gun, and passing the gun to No. 2. He dismounts the yoke, follows Nos. 1, 4, and 5 to the truck, and when the tripod is set up, mounts the yoke. He then returns to the position to assist Nos. 2 and 4 in carrying the remainder of the equipment to the truck. He takes post on the truck as directed by the squad leader.
No. 4	<i>Drill A.</i>—He disconnects the water hoses and coils them on the water chest. Assisted by No. 5, he removes the legs from the pedestal. He takes the pedestal off the rear of the truck and follows Nos. 1 and 3 to the gun position. Assisted by No. 5, he assembles the pedestal and legs. He returns to the truck for the water chest and hoses, carries them to the position, assisted by No. 5, and connects the water hoses to the gun. He then assists Nos. 2 and 3 in carrying the remaining equipment to the position. He takes post at the water pump. <i>Drill B.</i>—He disconnects the water hoses and coils them on the water chest. He assists Nos. 1 and 5 in folding up the tripod, removing it from the truck, carrying it to the position, and setting it up. He returns to the truck for the water chest and hoses and, assisted by No. 5, carries them to the position. He then connects the water hoses to the gun. He assists Nos. 2 and 3 in carrying the remaining equipment to the position. He then takes post at the water pump.	He sees that the water jacket is filled, that all water plugs and hose connections are tight, and that the water chest is filled and in working order. He also sees that a full water container is conveniently located. He then reports, "Water pump in order."	(a) He remains at the water pump. (b) If necessary, he shifts the position of the water chest to avoid being in front of the muzzle when fire is commenced.	He continuously operates the water pump.	(a) Continues to operate the water pump. (b) Continues to operate the water pump for about 20 full turns of the pump handle after the gun ceases firing. If necessary, he changes the water in the water chest.	<i>Drill A.</i>—He disconnects the water hoses and coils them on the water chest. Assisted by No. 5, he removes the legs from the pedestal. He then carries the pedestal to the truck, following No. 5. With the aid of No. 5, he assembles the pedestal and legs. He returns to the position for the water chest and hoses, carries them to the truck, and connects the water hoses to the gun. He then returns to the position to assist Nos. 2 and 3 in carrying the remainder of the equipment to the truck. He takes post on the truck convenient to the water pump. <i>Drill B.</i>—He disconnects the water hoses and coils them on the water chest. He assists Nos. 1 and 5 in folding up the tripod, removing it to the truck, and setting it up in the truck. He returns to the position for the water chest and hoses, carries them to the truck, and connects the water hoses to the gun. He then returns to the position to assist Nos. 2 and 3 in carrying the remainder of the equipment to the truck. He takes post on the truck convenient to the water pump.
No. 5	<i>Drill A.</i>—He maneuvers his truck as close to the designated position as circumstances permit, dismounts, and lowers the tail gate. He assists No. 4 in removing the legs from the pedestal. He carries the legs to the position, following No. 4. At the position he assists No. 4 in assembling the pedestal and legs. He then returns to the truck and assists No. 4 in carrying the water chest and hoses to the position. When all equipment is removed from the truck, he puts up the tail gate, moves the truck to the designated parking area, and then returns to the gun position. He takes post near the reserve ammunition. <i>Drill B.</i>—He maneuvers his truck as close to the designated position as circumstances permit, dismounts, and lowers the tail gate. He assists Nos. 1 and 4 in folding up the tripod, removing it from the truck, carrying it to the position, and setting it up. He then returns to the truck and assists No. 4 in carrying the water chest and hoses to the position. When all equipment is removed from the truck, he puts up the tail gate, moves the truck to the designated parking area, and then returns to the gun position. He takes post near the reserve ammunition.	He inspects the reserve ammunition and the link-loading machine, and if no firing is to occur, sees that no live ammunition is near the reserve chests. He then reports, "Reserve ammunition in order."	(a) Remains at the reserve ammunition chests. (b) Remains at the reserve ammunition chests.	He brings up reserve ammunition chests to the gun when called for by No. 2 and assists him in removing the old ammunition chest and mounting the new one. He loads additional belts, and obtains ammunition from the platoon when required.	(a) Continues as under COMMENCE FIRING. (b) Replaces the empty ammunition chest with a full one, if necessary. He loads belts with the assistance of other members of the squad until all ammunition chests are full.	<i>Drill A.</i>—He obtains his truck, maneuvers it as close to the gun position as circumstances permit, and lowers the tail gate. He then returns to the position and assists No. 4 in removing the legs from the pedestal. He carries the legs to the truck, following the squad leader. He assists No. 4 in assembling the pedestal and legs and attaching the amount to the truck. When all men and equipment are in the truck, he closes the tail gate. He then maneuvers his truck as directed. <i>Drill B.</i>—He obtains his truck, maneuvers it as close to the gun position as circumstances permit, and lowers the tail gate. He assists Nos. 1 and 4 in folding up the tripod, carrying it to the truck, and setting it up. When all men and equipment are in the truck, he closes the tail gate. He then maneuvers his truck as directed.

NOTES.

- See paragraph 42b in the text.
- Drill A* is for the M2 antiaircraft machine-gun mount. *Drill B* is for the M1 antiaircraft machine-gun mount.
- When the truck park is a considerable distance from the emplacement, the squad proceeds with **EXAMINE GUN** without waiting for No. 5, his duties being performed by No. 3.
- In assigning the target in units which normally employ central tracer control, the command, **TARGET—GUNNER'S ACTION**, is given if it is desired to employ individual tracer control.
- SUSPEND FIRING** is employed when a brief halt in firing is desired. **CEASE FIRING** is employed when an appreciable period of time is to elapse before firing is resumed.

APPENDIX

LIST OF REFERENCES

Ammunition for small arms and automatic guns.....	TM 9-1990 (now published as TR 1350-A).
Ammunition, general.....	TM 9-226 (now published as TR 1370-A).
Browning machine gun, caliber .50, M2, water-cooled (flex.).....	TM 9-226 (now published as TR 1300-50A).
Browning machine gun, caliber .50, M1921, water-cooled.....	TM 9-220 (now published as TR 1300-50B).
Browning machine gun, caliber .30, M1917, water-cooled.....	FM 23-55.
Camouflage and protective measures.....	FM 4-105.
Care of matériel.....	FM 4-120.
Commands.....	FM 4-105.
Examination for gunners.....	FM 4-150.
Formations and inspections.....	FM 4-120.
Gunnery and fire control.....	FM 4-112.
Organization of the mobile machine-gun battery.....	T/O 4-27.
Organization of the semimobile machine-gun battery.....	T/O 4-197.
Reconnaissance, selection, and occupation of positions.....	FM 4-105.
Safety precautions in firing.....	FM 4-120.
Service of matériel.....	FM 4-120.
Weapons and matériel.....	TM 4-210.

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